

Changes in the equine gut microbiome associated with a hospital stay

Jerrianne E. Whittmore¹, Aaron C. Ericsson², and Philip J. Johnson¹

¹ Department of Veterinary Medicine and Surgery and ²University of Missouri Metagenomics Center,
Department of Veterinary Pathobiology, College of Veterinary Medicine
University of Missouri, Columbia, Missouri


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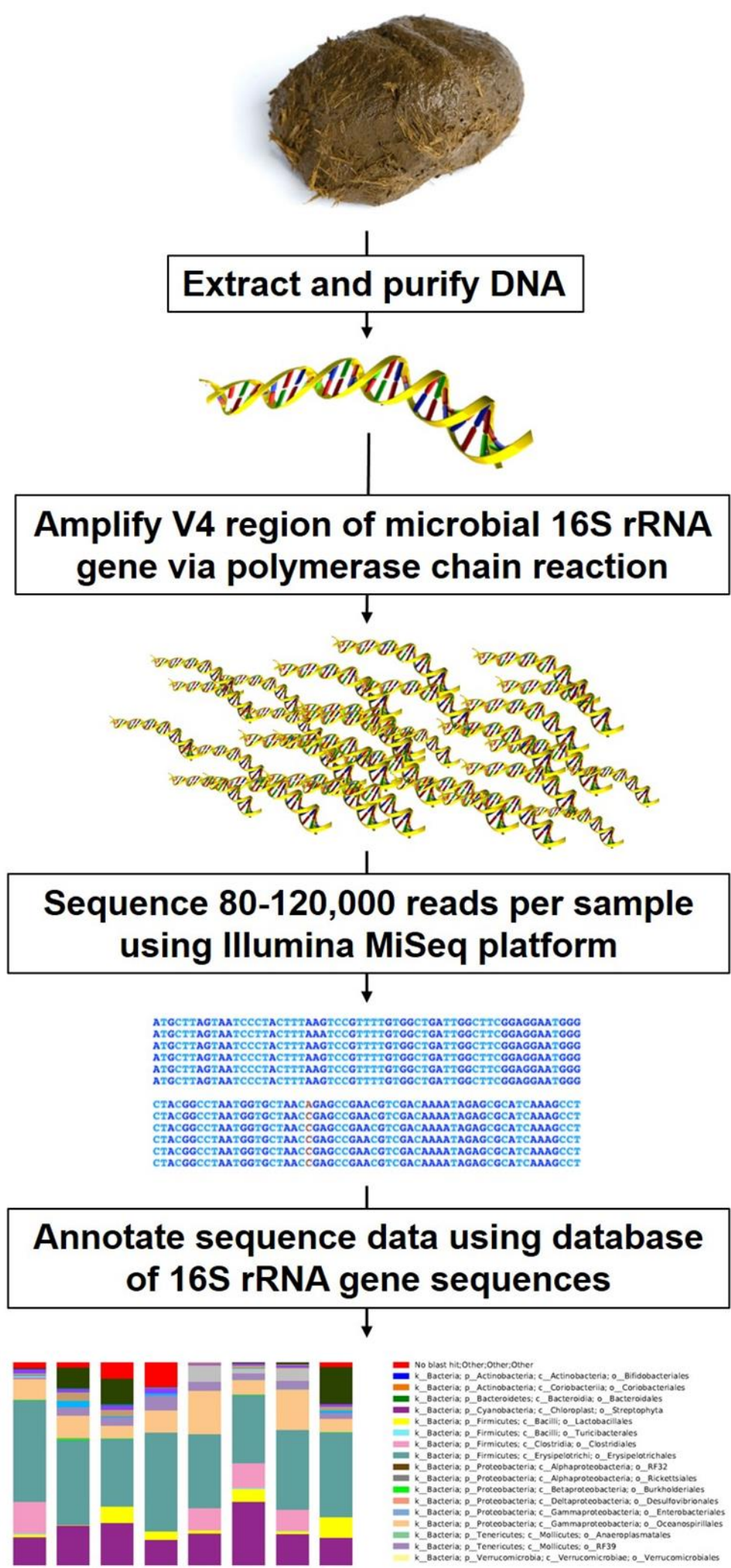
Background

- The microbiota, especially that of the gut, plays an important role in the overall health of the body.
- Studies done in humans have shown that alterations in the gut microbiome are associated with many common conditions.
- It is largely unknown how the health of horses is affected by shifts in the gut microbiome.

Objectives

- To survey the microorganisms present in the gastrointestinal tract of horses admitted into the University of Missouri Veterinary Medical Teaching Hospital and to observe changes that occur over the course of the hospital stay.

Methods



- Fecal samples were collected from every patient upon being admitted into the Veterinary Medical Teaching Hospital at the University of Missouri then again at discharge. Depending on the case, samples were collected at various points throughout the course of the stay.
- DNA extraction was performed using MoBio PowerFECAL Kits.

Patient Information

	Patient	Sample IDs	Time in VMTH	Breed	Age	Sex	Clinical Signs	Diagnosis
ACUTE GI SIGNS	1	JW4 5	1d	Spanish Mustang	23y	MC	colitis	colonopathy of unknown etiology
	2	JW6 8	3d	Thoroughbred	18y	F	colic, decreased appetite, diarrhea	colitis
	3	JW13	1d	Arabian	11y	F	colic	large colon impaction
	4	JW16	17d	Quarter Horse	16y	MC	colic	impaction
	5	JW22	5d	Standardbred	36h	Filly	bloody diarrhea	colitis
	6	JW48 51	2d	Quarter Horse	9y	F	colic	large colon impaction and right displacement
	7	JW53	8d	Gypsy Vanner	3d	Filly	diarrhea, lethargy, and fever	septicemia, c. difficile infection
	8	JW77	21d	Thoroughbred	3y	F	colic	small intestinal volvulus
CHRONIC GI SIGNS	43	JW78	7d	Belgian	9y	MC	right sided nasal mass	nasal mass, colitis
	9	JW10 11	3d	AQH	12y	MC	Diarrhea, colitis	colitis
	10	JW14 15	5d	American Saddlebred	1y	colt	colitis, pericardial effusion	colitis
	11	JW17 18	8d	MO fox trotting horse	15y	M	diarrhea	severe ulcerative gastritis
	12	JW19	1d	Tennessee Walking Horse	20y	MC	diarrhea, inappetence	ulcerative typhlocolitis
	13	JW25	4d	American Quarter Horse	12y	F	colic	unknown cause
	14	JW26	11d	American Quarter Horse	20y	F	inappetence, colic	small intestinal obstruction
	15	JW35 37	3d	Hanoverian	16y	MC	colic	not conclusive
	16	JW45 47	1d	American Quarter Horse	12y	MC	colic	pelvic flexure impaction
	17	JW57	1d	American Paint	23y	F	diarrhea, anorexia, cough, and weight loss	fibrosuppurative enterocolitis, bronchopneumonia
	18	JW58	2d	Thoroughbred/Irish Draught X	10y	MC	diarrhea, laminitis	unknown
	19	JW1	4d	Rocky Mountain Horse	4d	Filly	difficulty nursing	pharyngeal dysmaturity
	22	JW20 21	3d	Percheron	15y	MC	head shaking	unknown
	24	JW24	<1d	American Quarter Horse	11y	MC	generalized hyperesthesia	navicular syndrome
	25	JW27 28	4d	American Quarter Horse	2y	F	bute toxicity	bute toxicity
	NON-GI SIGNS	26	JW30	3d	American Quarter Horse	7y	F	injection reaction
27		JW31 33	7d	American Saddlebred	5mth	Colt	respiratory	bronchopneumonia
28		JW34	3d	Missouri Fox Trotter	12y	F	bikapharospasm, tearing	corneal ulcer
30		JW41 43	4d	Gypsy Vanner	6y	MC	respiratory	chronic endocrinopathic laminitis, metabolic syndrome
31		JW44	2d	American Quarter Horse	6y	F	trauma to right eye	rupture of right eye, lens prolapse
33		JW55	2d	Holsteiner	30y	F	choke	choke
34		JW56	<1d	Tennessee Walking Horse	18y	MC	swelling in sheath and belly	IBD, cancer
35		JW62	1d	American Quarter Horse	5y	MC	chronic coughing, weight loss	bronchitis, bronchopneumonia
36		JW66	4d	American Quarter Horse	14y	F	poss. Strangles signs	not conclusive
37		JW67	1d	American Quarter Horse	19y	MC	coughing, weight loss	recurrent airway obstruction, pars intermedia adenoma, thyroid follicular adenoma, nodular adrenocortical hyperplasia, glomerular and tubular sclerosis, nodular adrenocortical hyperplasia, glomerular and tubular sclerosis
40		JW72	4d	American Quarter Horse	5w	Colt	right sided facial swelling	Strangles
41		JW73 74	4d	American Quarter Horse	12y	MC	respiratory distress, swelling under chin	Strangles
20		JW2 3	4d	Rocky Mountain Horse	8y	F	N/A, accompanied foal	None
21		JW12	1d	American Quarter Horse	7y	F	N/A, reproductive exam	None
23		JW23	5d	American Trotter	10y	F	N/A, accompanied foal	None
29		JW38 40	7d	American Quarter Horse	12y	F	N/A, accompanied foal	None
32	JW52, JW54	8d	Gypsy Vanner	5y	F	N/A, accompanied foal	None	
38	JW68 69	4d	American Paint	21y	F	N/A, accompanied foal	None	
39	JW70 71	5d	Lippitt Morgan	21y	F	N/A, accompanied foal	None	
42	JW75 76	2d	Thoroughbred	7y	F	N/A, accompanied foal	None	

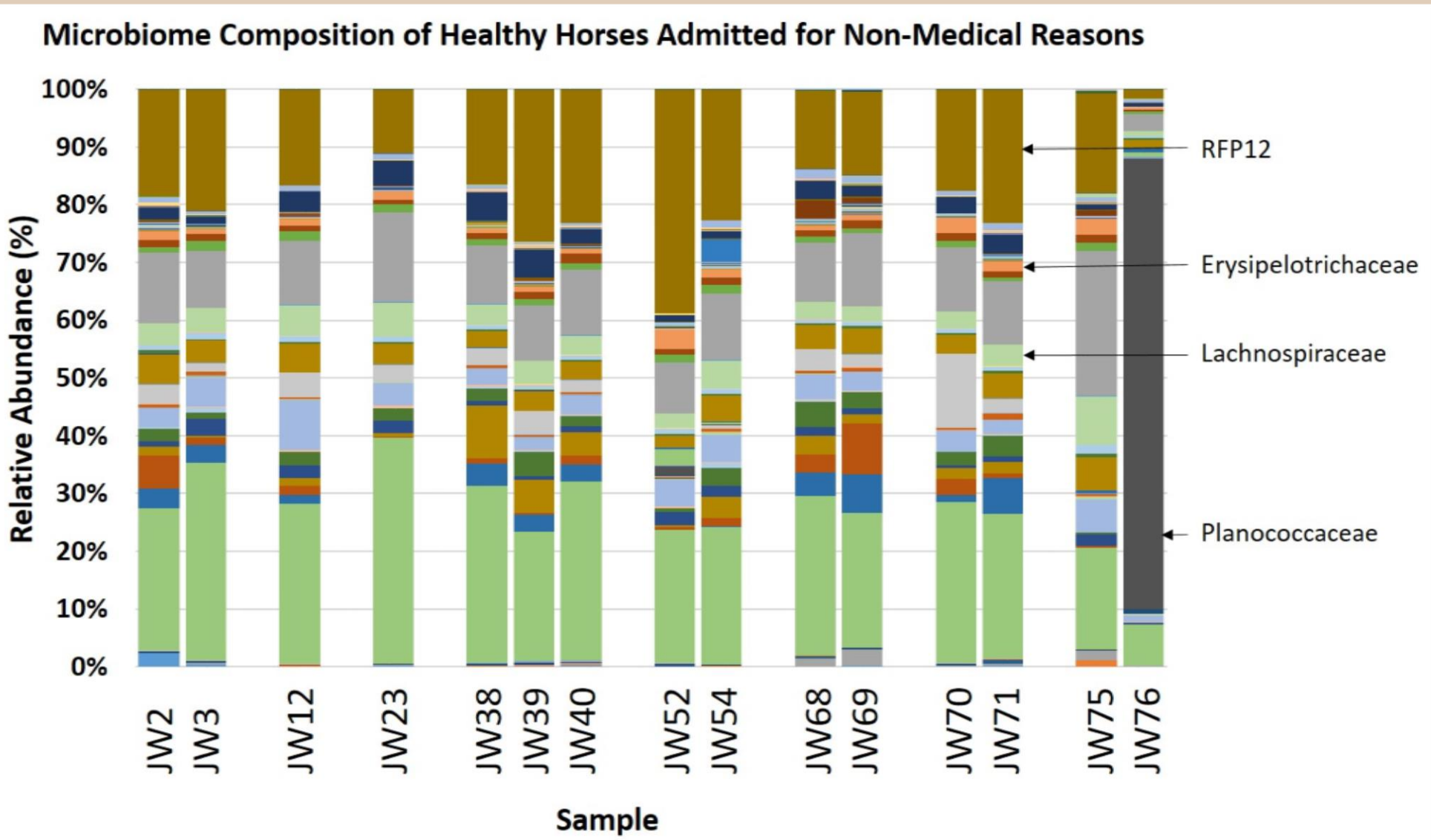


Figure 1: Stacked bar charts demonstrating the relative abundance of microbes at the taxonomic level of family detected in healthy horses admitted to the MU VMTH for non-medical reasons (as determined by 16S RNA sequencing).

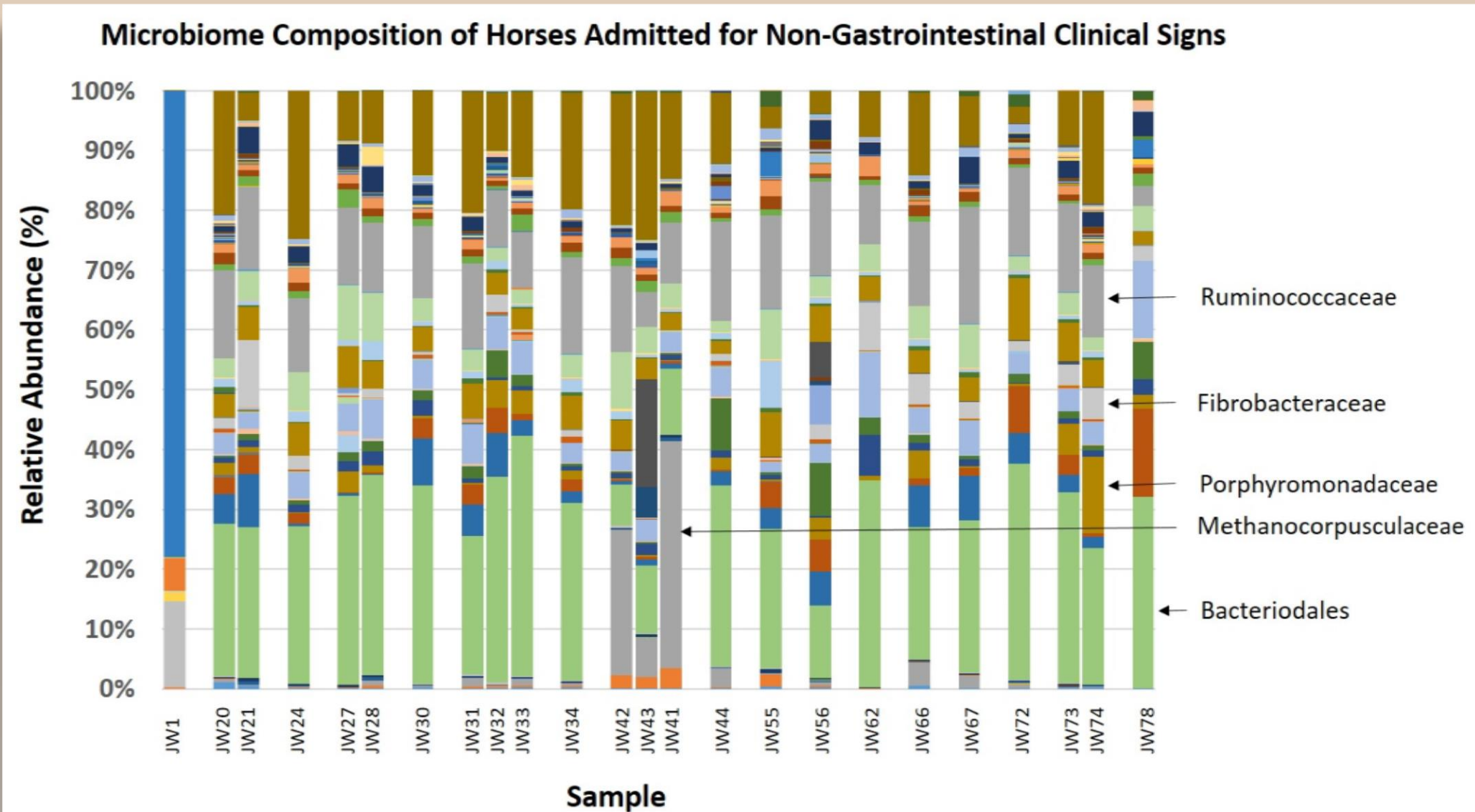


Figure 2: Stacked bar charts demonstrating the relative abundance of microbes at the taxonomic level of family detected in horses admitted to the MU VMTH for non-gastrointestinal clinical signs (as determined by 16S RNA sequencing).

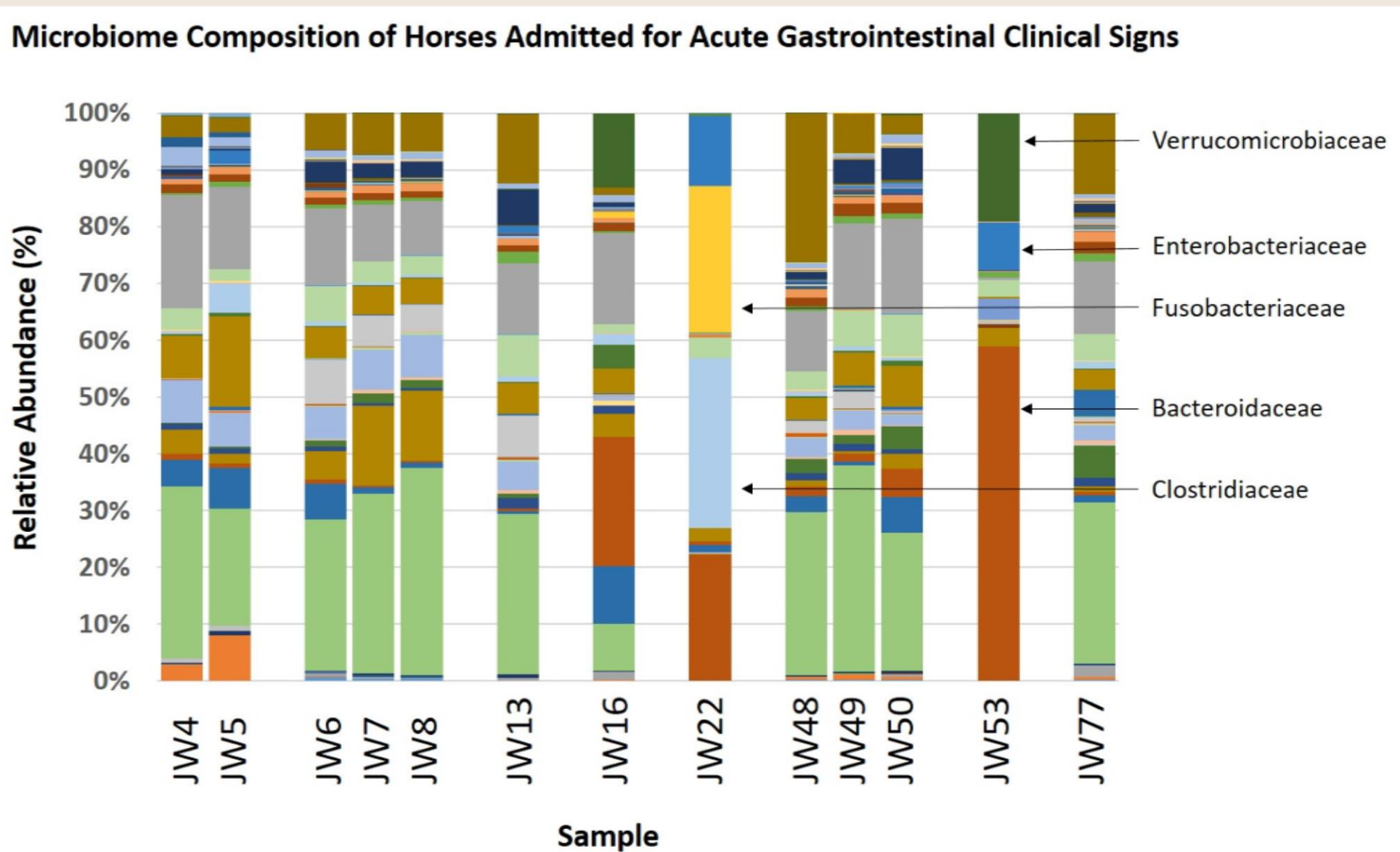


Figure 3: Stacked bar charts demonstrating the relative abundance of microbes at the taxonomic level of family detected in horses admitted to the MU VMTH for acute gastrointestinal clinical signs (as determined by 16S RNA sequencing).

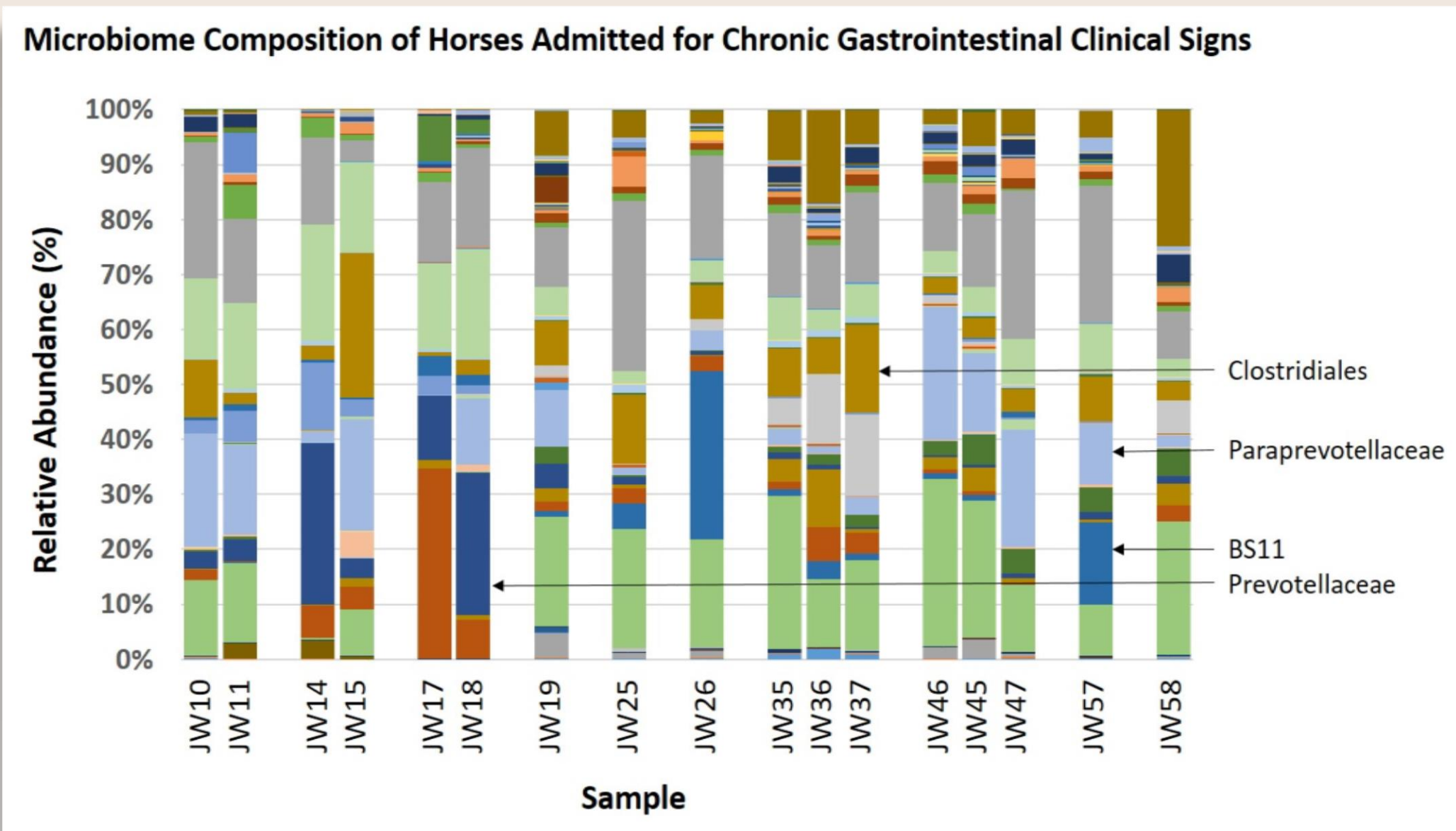


Figure 4: Stacked bar charts demonstrating the relative abundance of microbes at the taxonomic level of family detected in horses admitted to the MU VMTH for chronic gastrointestinal clinical signs (as determined by 16S RNA sequencing).

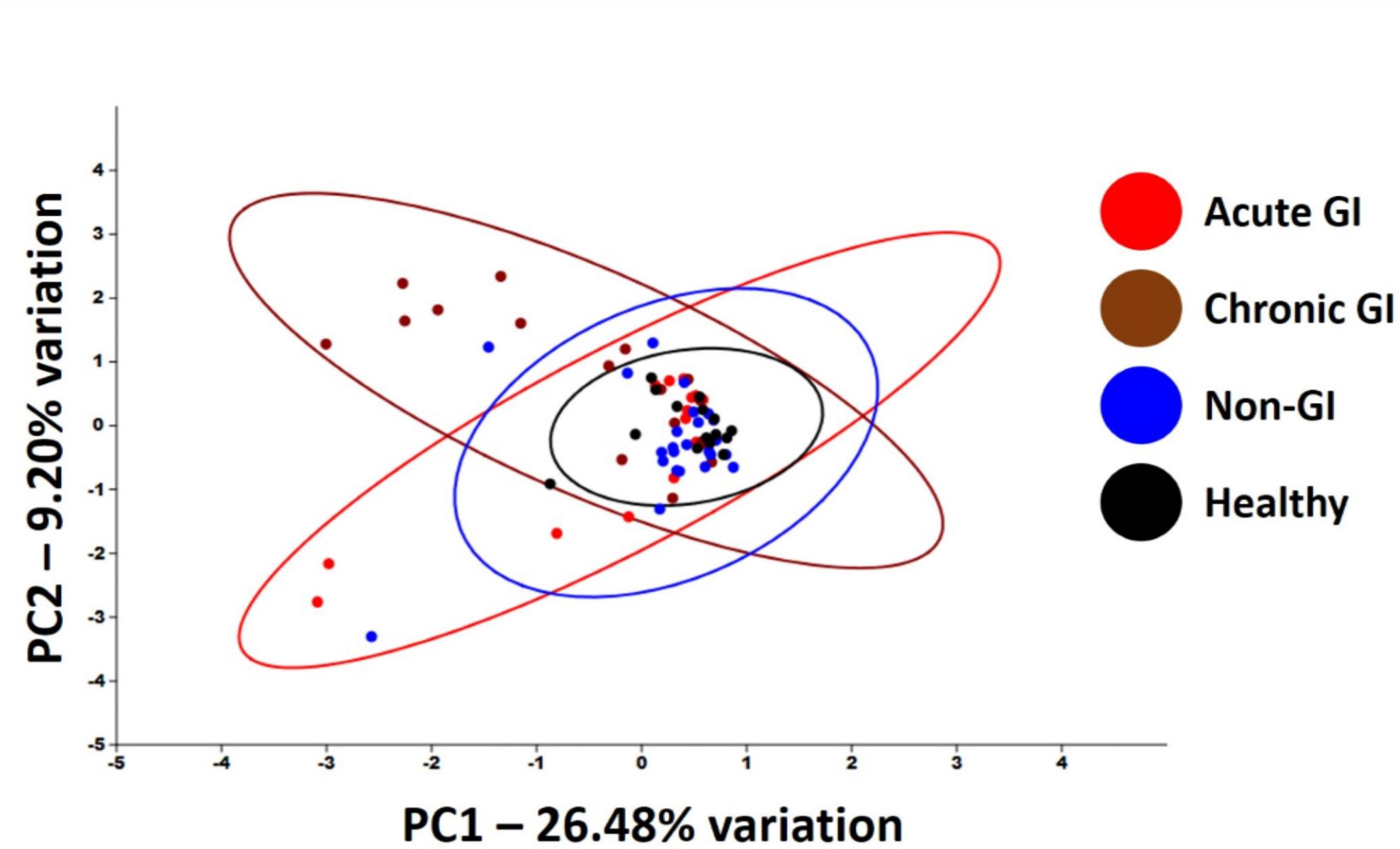


Figure 5: Principal component analysis of samples shown in figures 1-4 demonstrating compositional similarities among and between groups. Circles represent 95% confidence intervals.

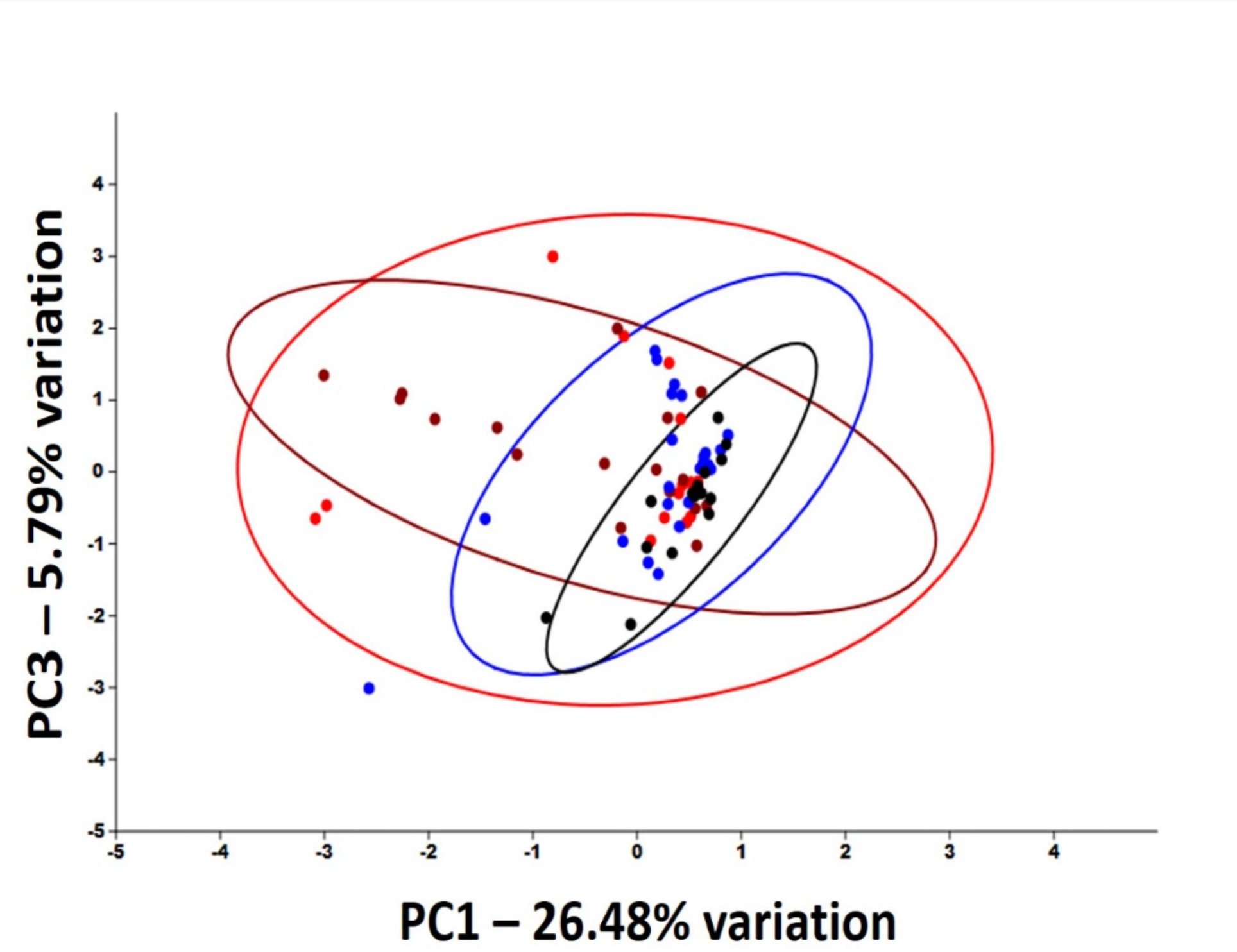


Figure 6: Principal component analysis of samples shown in figures 1-4 demonstrating compositional similarities among and between groups. Circles represent 95% confidence intervals.

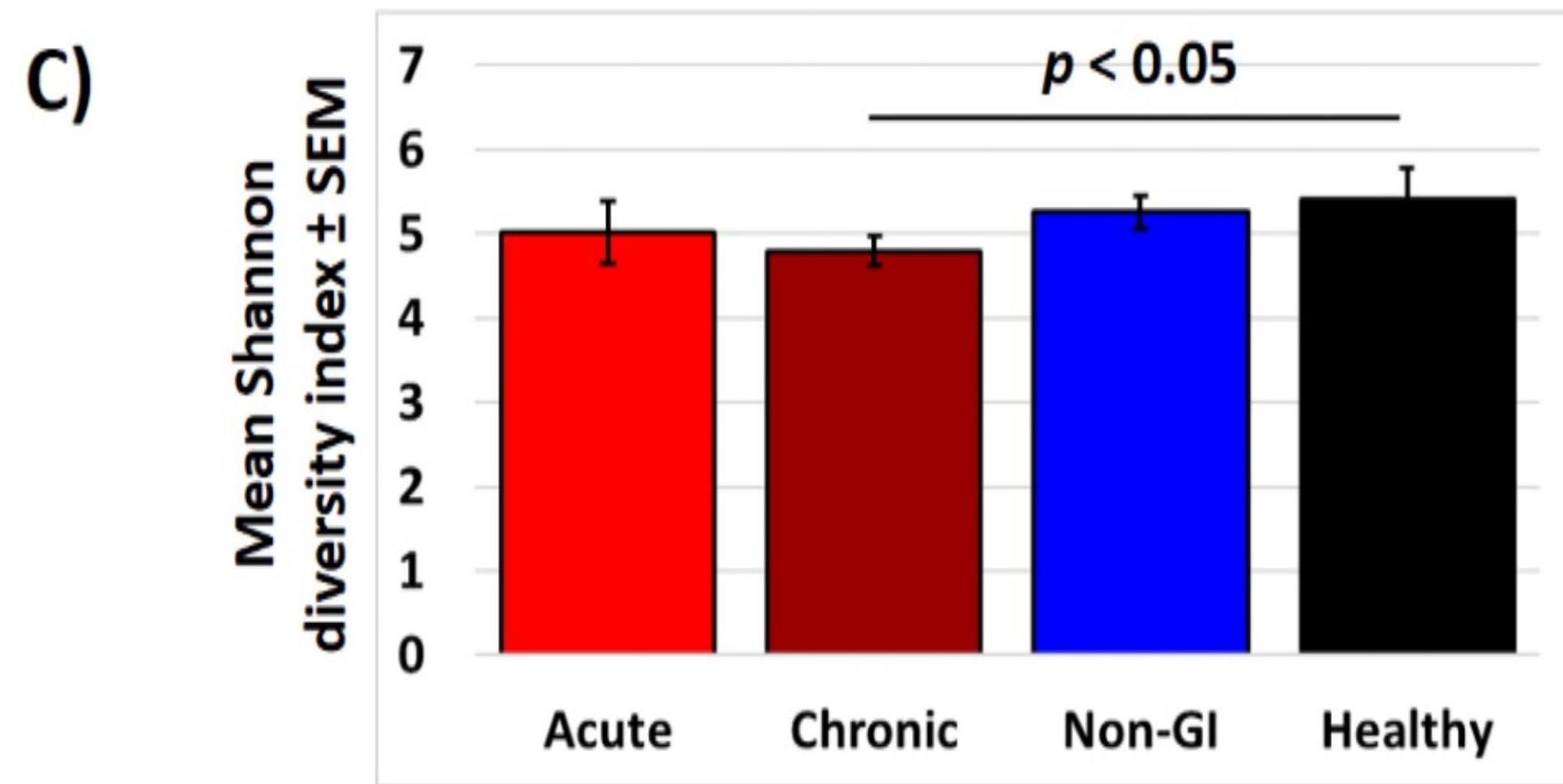
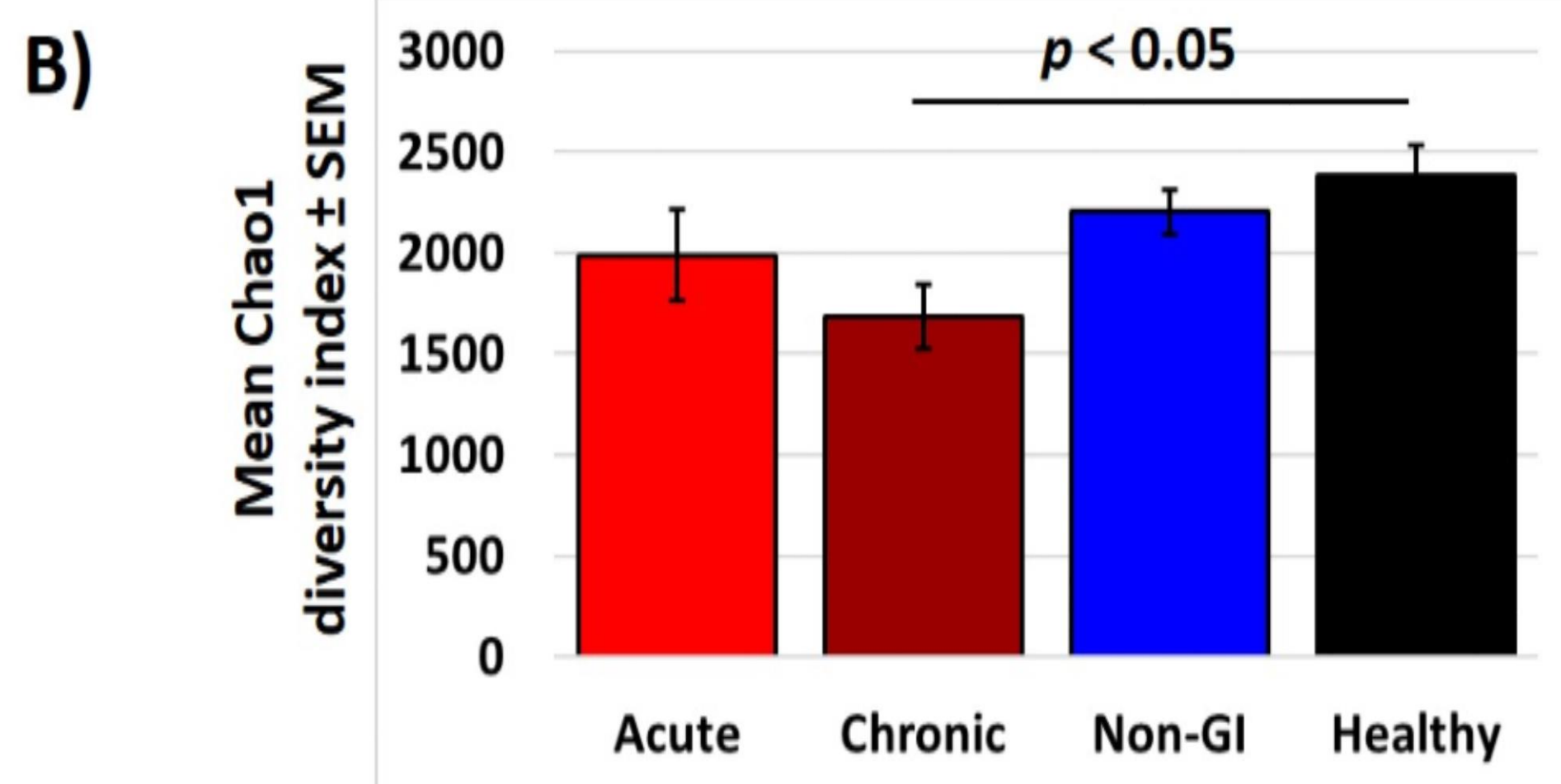
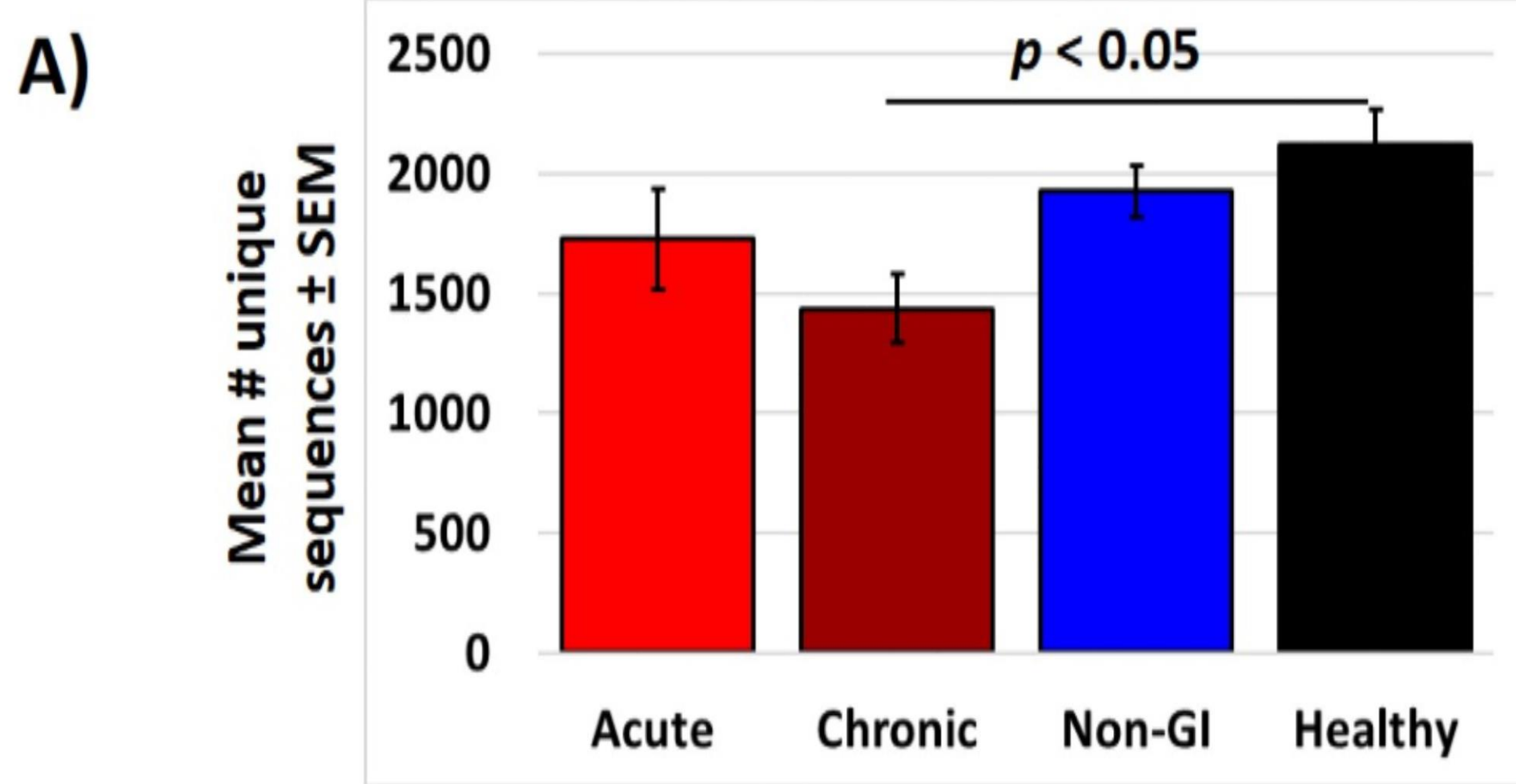


Figure 7: Bar charts showing mean \pm Standard Error of the Mean (SEM) of unique sequences detected (A), Chao1 Diversity index (B), or of Shannon Diversity Index (C). Bars indicate significant differences (ANOVA on ranks).

Conclusions

- The composition of the gastrointestinal microbiome of patients exhibiting acute GI signs and chronic GI signs were significantly different from each other, as well as from both the healthy patients and those exhibiting non-gastrointestinal clinical signs.
- There was no significant difference between the patients admitted for non-gastrointestinal signs and the healthy patients.
- Future research aims to draw conclusions about the stability of the gastrointestinal microbiome during the hospitalized period, what microorganisms drive the variation between groups, as well as compare hospitalized patients with normal horses out on pasture.

Acknowledgements

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