

FACTORS AFFECTING THE LONGITUDINAL STABILITY OF THE GASTROINTESTINAL MICROBIOME IN GORILLA (*GORILLA GORILLA GORILLA*) UNDER MANAGED CARE

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Abstract

A recent surge of microbiome research has characterized gastrointestinal microbiome (GIM) composition and diversity among mammalian species with the aim to use GIM analyses as a clinical tool. However, a basic understanding of the “normal variation” for GIMs in non-human primates is lacking. All gorilla species are critically endangered; thus, gorillas under human care are in critical need of conservation efforts. By combining information on health, nutrition, and GIM data, caretakers can improve the standard of care. The current study was conducted to characterize normal, microbial variation in zoo gorilla GIM, diets, and habitats at three zoos and evaluate differences in microbial richness and diversity. Samples were collected biweekly from 19 gorillas and zoo enclosures for seven months, diet samples were collected monthly (248 fecal, 41 diet and 57 environmental samples). Age, diet, housing, group structure, individual, and zoo significantly affected GIM richness and diversity ($P < 0.05$). All fecal samples contained *Prevotella* (carbohydrate generalist) and *Ruminococcaceae* (fiber specialist). Individual identity had the most consistent and significant effect on richness and diversity across institutions ($P < 0.05$). Changes in microbial abundance over time were noted only at Denver Zoo ($P < 0.05$) and not at the NC and Riverbanks Zoos. This temporal correlation may be linked to seasonal changes in Colorado, which may have affected the environment, available produce, or browse source over the course of the sampling period. Diet also significantly influenced richness and diversity ($P < 0.05$) at all three institutions. Together, our results suggest that each individual has a “cloud” of normal GIM variation. While some microbial taxa were detected in all gorillas, individual baselines may still provide a useful diagnostic tool for optimizing health and evaluating the impact of therapies such as antibiotics in primates under human management.