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Firmicutes and *Bacteroidetes* Explain Mass Gain Variation in an Obligate Hibernator

A thesis submitted in partial satisfaction of the requirements

for the degree Master of Science in Biology

by

Gina Clarise Johnson

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ABSTRACT OF THE THESIS

Firmicutes and *Bacteroidetes* Explain Mass Gain

Variation in an Obligate Hibernator

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Professor Daniel T. Blumstein, Chair

Body condition is an important life history challenge that directly impacts individual fitness and is particularly important for hibernating animals, whose maintenance of adequate body fat and mass is essential for survival. It is well documented that symbiotic microorganism's play a vital role in animal physiology and behavior. Recent work demonstrates that gut microbes are associated with fat accumulation and obesity; *Firmicutes* is consistently associated with obesity while *Bacteroidetes* is associated with leanness both in humans and other animals. The focus of most microbiome studies has been on human health or involved lab reared animals used as a model system. However, these microbes likely are important for individual fitness in wild populations and provide potential mechanistic insights into the adaptability and survival of wildlife. Here we test whether symbiotic microorganisms within the phyla of *Firmicutes* and *Bacteroidetes* are associated with summer mass gain in an exceptionally well-studied wild population of yellow-bellied marmots (*Marmota flaviventer*) by quantifying microbial abundance over five years of fecal samples (2015 – 2019) collected during their summer active season. Results show that marmots with higher mass gain rates have a greater abundance of *Firmicutes*. In contrast, higher abundance of *Bacteroidetes* was associated with lower mass gain rates, but only for marmots living in harsher environments. Similar patterns were found at the family level where *Ruminococcaceae*, a member of *Firmicutes*, was associated with higher mass gain rates, and *Muribaculaceae*, a member of *Bacteroidetes*, was associated with lower mass gain rates, and similarly in harsher environments. Although correlative, these results highlight the importance of symbiotic gut microbiota to mass gain in the wild, a trait associated with survival and fitness in many taxonomic groups.

The thesis of Gina Clarise Johnson is approved.

Pamela J. Yeh

Paul H. Barber

Daniel T. Blumstein, Committee Chair

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