The Effect of Microgravity on the Gut Microbiome

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Recently, many countries have announced plans for deep space missions, raising the question of how zero gravity affects the human body. Various studies on Earth and in space have addressed this question. However, the effect of zero gravity on the human gut microbiota has largely gone understudied. The importance of healthy gut microbiota is well-known, as the gut microbiome can affect a human's emotions and overall health. Due to this, I wanted to understand how the gut microbiome as a community would be affected by microgravity, which to my knowledge, has never been done before. To do this, I used a mixture of the 14 most common bacteria in the healthy human gut and then clinostats to simulate microgravity for 14 days. After the treatment period, both 16s rRNA amplicon and mRNA transcriptomic sequencing were done on Day 7 and 14 for 16s, while transcriptomics was done only on Day 14. Downstream R analysis, such as Differential Gene-Expression analysis, was used for further data analysis. My analysis has shown that species such as Bacteroides uniformis and Parabacteroides distasonis are highly affected by microgravity and have increased abundance. I also found that microgravity significantly affects gene expression, enhancing pathways related to biofilm creation and metabolite production while decreasing pathways related to common energy sources such as glucose degradation. My research also found that the greater the time spent in microgravity, the more impactful the changes are. My findings are significant to ensure the safety of manned deep space missions, such as sending humans to Mars.

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