Case Study on the Effects of a Gluten-Free Diet on Symptoms, the Gut Microbiome and DNA Methylation in Vegetarian Individuals With Crohn's Disease

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Crohn’s Disease is an autoimmune, inflammatory bowel disorder affecting millions of people globally, characterized by symptoms such as abdominal pain, vomiting, bloating and diarrhea. Current treatments include reducing inflammation by blocking production of pro-inflammatory cytokine, TNF-a with a drug called Infliximab. While effective, Infliximab also carries risk of adverse side effects like fever, nausea, jaundice and liver failure. However, various dietary interventions have been shown to mitigate inflammation and reduce drug reliance. This case study focuses on how a gluten-free diet (GFD) influences symptoms, the gut microbiome and DNA methylation patterns in vegetarian individuals with Crohn’s disease. Participants completed a daily survey to track their diet and symptoms while stool samples and PBMCs were collected four times over the course of 3 months. Nanopore sequencing was used to assess the bacterial community of the microbiome and methylation patterns of inflammation related genes. A McNemar test of the daily symptoms indicated that a GFD leads to a significant decline in symptoms, such as bloating and abdominal pain ($p < 0.05$). The decline in inflammation correlated with an increase in abundance of short chain fatty acid (SCFA) producing bacterial genera, namely, Anaerostipes, Lachnospira, Roseburia and Lactobacillus. These SCFAs are bioactive compounds which loosened DNA structure, allowing enzymes to enter and inhibit transcription of inflammatory signaling molecules IL8 and IL18. Altogether, changes in bacterial genera abundance and gene expression suggest suppression of inflammatory pathways TLR, p38 MAPK, and NF-kB. By modulating immune and inflammatory responses, a GFD shows promise in improving health for patients with Crohn’s disease.

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