

**The Forbidden COVID-19 Chronicles: Sept 13, 2021**  
**The Microbiome and COVID-19**  
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**According to Hippocrates, "All disease begins in the gut."**

The gut is the largest immune organ in the body and is colonized by a significant number of microorganisms, referred to as the microbiome. The microbiome plays a major role in the development and function of the immune system through signaling and crosstalk with immune cells throughout the body.<sup>1</sup> Therefore, it is not surprising that there is a connection between the gut microbiome, gastrointestinal symptoms, and COVID-19. A study published in April 2020 reported that 20% of patients with confirmed SARS-CoV-2 infection had gastrointestinal symptoms, and two thirds of infected people shed viral RNA in their feces. Over 60% of patients continued to shed RNA in their feces even after PCR tests showed negative results.<sup>2</sup>

Patterns in the makeup of the microbiome have been found to be related to patient outcomes for many diseases and conditions. Dysbiosis is characterized by a reduction in microbial diversity, along with the loss of beneficial bacteria and an increase in pathogenic bacteria. Patients with dysbiosis have worse outcomes and longer recovery times from COVID-19 than those who have healthier microbiomes.<sup>3</sup>

In order to look more closely at the relationship between SARS-CoV-2 and the gut, researchers in Hong Kong analyzed the microbiomes of 15 patients who tested positive in March 2020. They examined 2-3 fecal samples each week until the patients were discharged from the hospital. At that time, any patient who tested positive was required to be hospitalized, even if the person had no symptoms.

All of the patients had increased levels of pathogenic bacteria and reduced levels of beneficial bacteria as compared to healthy controls. Those who were treated with antibiotics had even less beneficial bacteria and higher levels of pathogenic bacteria. The degree of dysbiosis was directly related to the severity of symptoms, and negative changes to the microbiome persisted after the patients had cleared the infection.<sup>4</sup>

A larger study of 100 patients confirmed these results and also reported that higher levels of pathogenic bacteria were associated with higher levels of inflammatory cytokines. Follow-up with these patients showed a link between a damaged gut microbiome and persistent symptoms, sometimes referred to as "long COVID." On the other hand, people who completely recovered had a microbiome similar to those who were never infected.<sup>5</sup>

SARS-CoV-2 has an affinity for ACE-2 receptors, which are found throughout the human body including in the mucosal lining the human gut. It is thought that the ACE2

receptors play a role in regulating the microbiome, and infection interferes with this regulatory system. In other words, dysbiosis can increase the risk of symptomatic infection, and infection can cause or exacerbate dysbiosis. To that point, recent research showed that in a mouse model, SARS-CoV-2 directly and negatively affected the gut microbiome. The same research group analyzed 101 stool samples from human COVID-19 patients and reported that the samples showed significant dysbiosis, with blooms of opportunistic pathogenic bacteria and antibiotic-resistant bacteria in those who were hospitalized. Blood tests showed that bacteria had translocated from the gut to the circulatory system, which indicates a relationship between dysbiosis and the development of secondary infections.<sup>6</sup>

Still more evidence for the connection between COVID-19 and the gut microbiome is the fact that people who are diabetic, obese or have high blood pressure are at higher risk of COVID-19, and these patients also are known to have compromised gut microbiomes.<sup>7</sup>

What should you do in response to this information? Protect your microbiome! Avoid taking antibiotics whenever possible, since antibiotics cause dysbiosis. Change your diet. Beneficial bacteria thrive on carbohydrate and fiber, and vegetarians tend to have healthier microbiomes with higher counts of beneficial bacteria than meat eaters.<sup>8</sup> If your microbiome has been compromised, you can address this with by improving your diet and taking a high-quality probiotic.

If you get COVID-19, taking a probiotic may be helpful. A pilot study involving 25 COVID-19 patients given probiotics showed that they had higher levels of beneficial bacteria in their gut, lower levels of inflammatory markers and were more likely to recover fully than 30 controls who were given usual care without probiotics.<sup>9</sup>

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<sup>1</sup> Geuking M, Cahenzli J, Lawson M. "Intestinal bacterial colonization induces mutualistic regulatory T cell responses." *Immunity*. 2011; 34(5), 794-806.

<sup>2</sup> Chen Y, Chen L, Deng Q et al. "The presence of SARS-CoV-2 RNA in the feces of COVID-19 patients." *J Med Vir* 2020 Apr <https://doi.org/10.1002/jmv.25825>

<sup>3</sup> Nogrady B. "Gut Microbiome May Help or Hinder Defenses Against Sars-CoV-2." *The Scientist* Aug 31 2021

<sup>4</sup> Zuo T, Zhang F, Liu GC et al. "Alterations in Gut Microbiota of Patients With COVID-19 During Time of Hospitalization." *Gastroenterology* 2020 Sep;159:944-965

<sup>5</sup> Yeoh YK, Zuo T, Liu GC et al. "Gut microbiota composition reflects disease severity and dysfunctional immune responses in patients with COVID-19." *Gut* 2021 Apr;70(4):698-706

<sup>6</sup> Venzon M, Bernard L, Klein J et al. Gut microbiome during COVID-19 is associated with increased risk of bacteremia and microbial translocation." *bioRxiv* doi: <https://doi.org/10.1101/2021.07.15.452246>

<sup>7</sup> Bull MJ, Plummer NT. "Part I: The Human Gut Microbiome in Health and Disease." *Integr Med (Encinitas)* 2014 Dec;13(6):17-22

<sup>8</sup> De Fillipo C, Cavalieri D, Di Paola M et al. "Impact of diet in shaping gut microbiota revealed by a comparative study in children from Europe and rural Africa." *PNAS* 2010 Aug;107(33):14691-14696

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<sup>9</sup> Nogrady B. "Gut Microbiome May Help or Hinder Defenses Against Sars-CoV-2." *The Scientist* Aug 31 2021