Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

LETTER TO THE EDITOR

Probiotics for the Prevention of COVID-19 Sequelae

Dear Editor,

The review article written by Kurian SJ, et al. (1) elegantly summarized the role of probiotics in mitigating the severity of coronavirus disease 2019 (COVID-19). Specifically, the authors explained how (1) probiotics can inhibit the cytokine storm associated with COVID-19 by stimulating innate immunity and, at the same time, preventing the over-stimulation of adaptive immunity. Therefore, we agree with the authors' recommendation to investigate the effects of probiotics among high-risk patients with COVID-19 and those with a severe course of COVID-19, in clinical trials, where probiotics might influence their prognosis. Nevertheless, examples of specific strains of probiotics that might benefit patients with COVID-19 were not mentioned.

Recently, we came across the findings of a new study (2) which could expand our understanding of the role of probiotics in the management of COVID-19. The study (2) aimed to evaluate the functional role of the microbiota in the long-term consequences of COVID-19, in which the researchers characterized the gut microbiota retrieved from patients with COVID-19 and compared with healthy controls, and also determined the effects of human fecal microbiota transfer from patients with COVID-19 to germ-free mice. In the study (2), it was observed that the gut microbiota of patients with COVID-19 comprised a significantly higher level of multidrug-resistant Enterobacteriaceae compared to that of healthy individuals. In addition, microbiota transfer from subjects with COVID-19 induced impaired lung defense and deterioration of brain cognitive functions in mice without SARS-CoV-2, suggesting microbiota as the culprit.

The findings of the aforementioned study indicate the potential use of probiotics that can decolonize antimicrobial-resistant Enterobacteriaceae in patients with COVID-19 to mitigate the long-term sequelae ("long COVID"). Indeed, probiotics, including the *Lactobacillus* and *Bifidobacterium* species, have been used as dietary supplements to decrease potential gut pathogenic *Enterobacteriaceae*. For instance, the use of *L. rhamnosus* GG supplementation in HIV-infected individuals has been shown to result in a reduction in Enterobacteriaceae in the gut with an associated decrease in intestinal inflammation (3). With the newest understanding of the role of gut microbiota in patients with COVID-19, future clinical trials involving probiotics in patients with COVID-19 should investigate the probiotic strains with Enterobacteriaceae-decolonizing effect to determine their efficacy in terms of preventing COVID-19 sequelae.

Competing Interest

All authors declare no conflicts of interest.

Supplementary Materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.arcmed.2022.08.004.

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