Front Immunol. 2020 Jul 14:11:1782. doi: 10.3389/fimmu.2020.01782. eCollection 2020.

Could the Induction of Trained Immunity by β-Glucan Serve as a Defense Against COVID-19?

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Abstract

As the SARS-CoV-2 virus wreaks havoc on the populations, health care infrastructures and economies of nations around the world, finding ways to protect health care workers and bolster immune responses in the general population while we await an effective vaccine will be the difference between life and death for many people. Recent studies show that innate immune populations may possess a form of memory, termed Trained Immunity (TRIM), where innate immune cells undergo metabolic, mitochondrial, and epigenetic reprogramming following exposure to an initial stimulus that results in a memory phenotype of enhanced immune responses when exposed to a secondary, heterologous, stimulus. Throughout the literature, it has been shown that the induction of TRIM using such inducers as the BCG vaccine and β-glucan can provide protection through altered immune responses against a range of viral infections. Here we hypothesize a potential role for β-glucan in decreasing worldwide morbidity and mortality due to COVID-19, and posit several ideas as to how TRIM may actually shape the observed epidemiological phenomena related to COVID-19. We also evaluate the potential effects of β-glucan in relation to the immune dysregulation and cytokine storm observed in COVID-19. Ultimately, we hypothesize that the use of oral β-glucan in a prophylactic setting could be an effective way to boost immune responses and abrogate symptoms in COVID-19, though clinical trials are necessary to confirm the efficacy of this treatment and to further examine differential effects of β-glucan's from various sources.

Keywords: COVID-19; SARS-CoV-2; innate immunity; trained immunity; β-glucan.

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References

1. Purvis A, Hector A. Getting the measure of biodiversity. Nature. (2000) 405:212–9. 10.1038/35012221 - DOI - PubMed
2. Flajnik MF. A cold-blooded view of adaptive immunity. Nat Rev Immunol. (2018) 18:438–53. 10.1038/s41577-018-0003-9 - DOI - PMC - PubMed
3. Netea MG, Quintin J, van der Meer JW. Trained immunity: a memory for innate host defense. Cell Host Microbe. (2011) 9:355–61. 10.1016/j.chom.2011.04.006 - DOI - PubMed
4. Naeslund C. Expérience de vaccination par le BCG dans la province du norrbotten. Revue Tuberculose. (1931) 12:617–36.
5. Di Luzio NR, Williams DL. Protective effect of glucan against systemic Staphylococcus aureus septicemia in normal and leukemic mice. Infect Immun. (1978) 20:804–10. - PMC - PubMed