



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.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Contents lists available at ScienceDirect

## Diabetes &amp; Metabolic Syndrome: Clinical Research &amp; Reviews

journal homepage: [www.elsevier.com/locate/dsx](http://www.elsevier.com/locate/dsx)

Letter to the Editor

## Response to the letter of L. Santacroce regarding article “Enhancing immunity in viral infections, with special emphasis on COVID-19: A review” (Jayawardena et al.)



Dear Sir,

We would like to express our gratitude for the opportunity to respond to the discussion letter by Dr. Santacroce and to clarify aspects of our opinion in relation to the accentuated concerns. We also appreciate Dr. Santacroce's keen interest, taking time to enrich the discussion of our article titled “Enhancing immunity in viral infections, with special emphasis on COVID-19: A review” [1]. The discussion letter has highlighted the mechanism of probiotics and gut microbiota in relation to the concept of gut-lung axis. We are in agreement with the discussed concept as there is enough evidence to indicate a link between gut microbiota and lung immunity [2].

Findings from previous studies on Severe Acute Respiratory Syndrome (SARS) have shown that coronaviruses demonstrate a tropism for the gastrointestinal tract [3]. Several recent studies have showed the presence of viral RNA in faces or anal/rectal swabs of Covid-19 patients, even after the clearance of the virus from the upper respiratory tract [4]. It is reported that the ACE2 receptors to which SARS-coronavirus (SARS-CoV) is attached for cellular entry, are highly expressed in enterocytes in the small intestine of mice, indicating that this place could be an underestimated site of SARS-CoV-2 infection [5].

A COVID-19 patient with multiple complications reported a favourable outcome after administration of probiotics, including *Lactobacillus acidophilus*, *Bifidobacterium* and *Saccharomyces boulardii*, along with vitamins & minerals [6]. Similarly, a 9 years old boy diagnosed with COVID 19 exhibited disappearance of mild diarrhoea symptoms when administered probiotics [6]. The usefulness of probiotics in the treatment and prevention of viral infections are clear, due to their proven immunomodulatory activity and ability to stimulate interferon production [6]. Therefore the gut–lung axis explains the possible relationship likely to occur between respiratory diseases and the gut microbiome [2]. An ongoing clinical trial (NCT04366180) on supplementing probiotics (*Lactobacillus Coryniformis* K8) for the prevention of COVID-19 in healthcare workers will enable us to further understand their therapeutic benefits.

### References

- [1] Jayawardena R, Sooriyaarachchi P, Chourdakis M, Jeewandara C, Ranasinghe P. Enhancing immunity in viral infections, with special emphasis on COVID-19: a review. *Diabetes Metab. Syndr.* 2020;14(4):367–82.
- [2] Marsland BJ, Trompette A, Gollwitzer ES. The gut–lung axis in respiratory disease. *Annals Am Thoracic Soc* 2015;12:S150–6.
- [3] Wong SH, Lui RN, Sung JJ. Covid-19 and the digestive system. *J Gastroenterol Hepatol* 2020;35:744–8.
- [4] Zhang W, Du R-H, Li B, Zheng X-S, Yang X-L, Hu B, et al. Molecular and serological investigation of 2019-nCoV infected patients: implication of multiple shedding routes. *Emerg Microb Infect* 2020;9:386–9.
- [5] Liang W, Feng Z, Rao S, Xiao X, Xue X, Lin Z, et al. Diarrhoea may be underestimated: a missing link in 2019 novel coronavirus. *Gut* 2020;69:1141–3.
- [6] Pourhossein M, Moravejolahkami AR. Probiotics in viral infections, with a focus on COVID-19: a Systematic Review. 2020.

Ranil Jayawardena<sup>a,b,\*</sup>, Piumika Sooriyaarachchi<sup>b,c</sup>,  
Michael Chourdakis<sup>d</sup>, Chandima Jeewandara<sup>e</sup>,  
Priyanga Ranasinghe<sup>f</sup>

<sup>a</sup> Department of Physiology, Faculty of Medicine, University of Colombo, Colombo, Sri Lanka

<sup>b</sup> Queensland University of Technology (QUT), Faculty of Health, School of Exercise and Nutrition Sciences, Brisbane, Queensland, Australia

<sup>c</sup> Health and Wellness Unit, Faculty of Medicine, University of Colombo, Colombo, Sri Lanka

<sup>d</sup> Laboratory of Hygiene, Social & Preventive Medicine and Medical Statistics, School of Medicine, Faculty of Health Sciences, Aristotle University of Thessaloniki, University Campus, 4, Thessaloniki, Greece

<sup>e</sup> National Center for Primary Care and Allergy Research, University of Sri Jayawardenepura, Sri Lanka

<sup>f</sup> Department of Pharmacology, Faculty of Medicine, University of Colombo, Colombo, Sri Lanka

\* Corresponding author. Department of Physiology, Faculty of Medicine, University of Colombo, Colombo, Sri Lanka.  
E-mail address: [ranil@physiol.cmb.ac.lk](mailto:ranil@physiol.cmb.ac.lk) (R. Jayawardena).