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Can lactoferrin boost human immunity against COVID-19?

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COVID-19 caused by Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) belonging to the family *Coronaviridae* [1] has become a pandemic disease that emerged in China in late 2019 and has since spread worldwide. This family of virus includes two other pathogenic human respiratory coronaviruses: SARS-CoV-1 and Middle East Respiratory Syndrome Coronavirus (MERS-CoV). SARS-CoV-2's genome was found to be almost 80% identical to SARS-CoV-1 [2]. The new emerging virus is transmitted through respiratory droplets, where it enters the human body through airway epithelial cells. It can also be transmitted through aerosol droplets, contaminated surfaces and person-to-person contact [1].

So far, current protection and treatment approaches have proven to be insufficient, and thus far a potent antiviral drug is yet to be found. Due to the critical status of the disease, there are strong efforts to find a novel, efficient and safe drug that can suppress the infection.

One possible solution might be found in Lactoferrin (LF), which is an innate immunomodulatory glycoprotein (80 kDa) that is naturally produced in human and bovine milk. The highest concentration of LF is in the colostrum of human breast milk that decreases gradually during lactation. LF is also found in the mucosa which presents the primary defense against respiratory microbial infections [3]. LF has been reported to have significant antimicrobial activity [4]. Furthermore, it plays an antiviral role against a wide range of human and animal viruses including rotavirus, respiratory syncytial virus, herpes viruses, hepatitis C and Human Immunodeficiency Virus (HIV) [3,5]. The antiviral role of LF has two routes: inhibition of virus replication inside the host cells; or prevention of infection by direct binding to virus particles or to viral receptors or co-receptors of the host cell. Several studies have proved the presence of anti-inflammatory, antitumoral and antiviral properties in LF [5].

It was reported that saturation of LF with metals (iron, zinc or manganese) prevented the attachment of a number of viruses such as poliovirus, Herpes Simplex Virus (HSV) and HIV to host cells. Also, it was shown that the conjugated LF with Zinc inhibited virus replication even when added after the virus' entry [3]. However, other studies have found that metal-free LF (apo-LF) was more efficient in inhibiting rotavirus replication than metal-saturated LF [5].

It has been reported that LF shows an inhibitory activity against SAR-CoV-1 by preventing the attachment of the virus [6]. In this study, LF was able to block the binding of spike proteins to the host cells, thus forming a host-defense mechanism against the virus. It also boosted the host's innate immunity by enhancing natural killer cells and neutrophil aggregation and adhesion [6].

There are recent and ongoing studies that are testing LF effectiveness as a cure for COVID-19 [7]. Therefore, it could be speculated that lactoferrin or metal- conjugated-lactoferrin may represent a potent new viral biocontrol drug that has the potential to boost the innate human immune system against COVID-19.

Disclosure statement

The authors declare no conflict of interest.

Authors' contributions

M.A. and S.E. conceived the idea, drafted the manuscript, revised the first draft and read and approved the final version of the manuscript.

References

[1] Wu Z, McGoogan JM. Characteristics of and important lessons from the Coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese center for disease control and prevention. JAMA. 2020;323:1239.
[2] Perlman S. Another decade, another coronavirus. N Engl J Med. 2020;382:760–762.
[3] van der Strate BW, Beljaars L, Molema G, et al. Antiviral activities of lactoferrin. Antiviral Res. 2001;52:225–239.
[4] Bruni N, Capucchio MT, Biasibetti E, et al. Antimicrobial activity of lactoferrin-related peptides and applications in human and veterinary medicine. Molecules. 2016;21:752.

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[5] Florian PE, Trif M, Evans RW, et al. On the antiviral activity of lactoferrin. Rom J Biochem. 2009;46 (2):187–197.
[6] Lang J, Yang N, Deng J, et al. Inhibition of SARS pseudovirus cell entry by lactoferrin binding to heparan sulfate proteoglycans. PLoS ONE. 2011;6 (8):e23710.
[7] Serrano G, Kochergina I, Albors A. et al. Liposomal lactoferrin as potential preventative and cure for COVID-19. Int J Res Health Sci. 2020;8(1):8–15.