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# Probable positive effects of the photobiomodulation as an adjunctive treatment in COVID-19: A systematic review

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[Marzieh Nejatifard](#)<sup>1</sup>, [Sohrab Asefi](#)<sup>2</sup>, [Raika Jamali](#)<sup>3</sup>, [Michael R Hamblin](#)<sup>4</sup>, [Reza Fekrazad](#)<sup>5</sup>

Affiliations

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## Abstract

**Background:** COVID-19, as a newly-emerged viral infection has now spread all over the world after originating in Wuhan, China. Pneumonia is the hallmark of the disease, with dyspnea in half of the patients and acute respiratory distress syndrome (ARDS) in up to one-third of the cases. Pulmonary edema, neutrophilic infiltration, and inflammatory cytokine release are the pathologic signs of this disease. The anti-inflammatory effect of the photobiomodulation (PBM) has been confirmed in many previous studies. Therefore, this review study was conducted to evaluate the direct effect of PBM on the acute lung inflammation or ARDS and also accelerating the regeneration of the damaged tissues. The indirect effects of PBM on modulation of the immune system, increasing the blood flow and oxygenation in other tissues were also considered.

**Methodology:** The databases of PubMed, Cochrane library, and Google Scholar were searched to find the relevant studies. Keywords included the PBM and related terms, lung inflammation, and COVID-19 -related signs. Studies were categorized with respect to the target tissue, laser parameters, and their results.

**Results:** Seventeen related papers were included in this review. All of them were in animal models. They showed that the PBM could significantly decrease the pulmonary edema, neutrophil influx, and generation of pro-inflammatory cytokines (tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ), interleukin 1 beta (IL-1 $\beta$ ), interleukin 6 (IL-6), intracellular adhesion molecule (ICAM), reactive oxygen species (ROS), isoform of nitric oxide synthase (iNOS), and macrophage inflammatory protein 2 (MIP-2)).

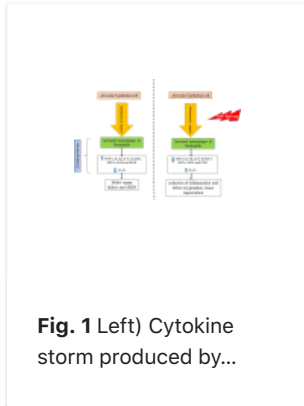
**Conclusion:** Our findings revealed that the PBM could be helpful in reducing the lung inflammation and promoting the regeneration of the damaged tissue. PBM can increase the oxygenation indirectly in order to rehabilitate the affected organs. Thus, the infra-red lasers or light-emitting

diodes (LEDs) are recommended in this regard.

**Keywords:** COVID-19; Laser therapy; Low-level laser therapy; Photobiomodulation; SARS Cov2; Virus.

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## Figures



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