proceedings

MDPI

Abstract

Disentangling the Immunomodulatory Effects of Vitamin D on the SARS-CoV-2 Virus by In Vitro Approaches †

Ángela Alcalá-Santiago [1,2,3,*,‡], Noelia M. Rodríguez-Martin [4,‡], Justo Pedroche [4] and Esther Molina-Montes [1,2,3,5]

1 Department of Nutrition and Food Science, Faculty of Pharmacy, University of Granada, 18071 Granada, Spain; memolina@ugr.es
2 Instituto de Investigación Biosanitaria ibs.GRANADA, 18012 Granada, Spain
3 Institute of Nutrition and Food Technology (INYTA) 'José Mataix', Biomedical Research Centre, University of Granada, Avenida del Conocimiento s/n, 18071 Granada, Spain
4 Group of Plant Proteins, Instituto de la Grasa, CSIC, Ctra. de Utrera Km. 1, 41013 Seville, Spain; nmrodriguez@ig.csic.es (N.M.R.-M.); j.pedroche@csic.es (J.P.)
5 CIBER de Epidemiología y Salud Pública (CIBERESP), 28029 Madrid, Spain
* Correspondence: angela.alcala@ugr.es
† Presented at the 14th European Nutrition Conference FENS 2023, Belgrade, Serbia, 14–17 November 2023.
‡ These authors contributed equally to this work.

Abstract: Vitamin D is a fat-soluble vitamin with multiple functions, including the modulation of the immune response, amongst others. Earlier studies have demonstrated that the active form of vitamin D, 1,25-dihydroxivitamin D, inhibits LPS-induced IL-6 and TNF-α production by human monocytes in a dose-dependent manner. On the other hand, some in vitro studies support that this vitamin has immune modulatory effects on viral infections. However, it remains unclear whether vitamin D regulates the immune response in infectious diseases triggered by viruses such as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes COVID-19. This study aimed to evaluate the anti-inflammatory properties of vitamin D against the spike protein of the SARS-CoV-2 virus. For this purpose, vitamin D was used in two different doses of 10 and 25 nM on the THP-1 cell line, which was stimulated with low doses of the SARS-CoV-2 virus spike protein. The THP-1 cell line, which is derived from human monocytic cells, was chosen since it contains the ACE2 transporter of the spike protein. Moreover, it is a widely used model to examine inflammatory processes due to its potential to stimulate inflammation and the release of inflammatory cytokines. The THP-1 cells were incubated for 1 h with the spike protein, subsequently treated with the two selected doses of vitamin D and incubated for 24 h. ELISA and RT-qPCR techniques were used to quantify the levels of inflammatory cytokines. Our results showed that vitamin D had no effect on the mRNA transcriptional levels of cytokine IL-6, but it was able to down-regulate the transcriptional levels of the pro-inflammatory cytokines IL-1β and TNF-α. There was no dose–response relationship between vitamin D and the expression of these genes. In conclusion, vitamin D inhibited inflammatory cytokine production on spike protein-stimulated inflammation in the THP1 cell line. The study is being completed by testing higher doses of vitamin D and of the spike protein. Additionally, other markers of inflammation are being measured through the use of transcriptomic analyses of the control vs. treated THP1 cells.

Keywords: vitamin D; SARS-CoV-2 virus; immunomodulatory effects

Citation: Alcalá-Santiago, Á.; Rodríguez-Martin, N.M.; Pedroche, J.; Molina-Montes, E. Disentangling the Immunomodulatory Effects of Vitamin D on the SARS-CoV-2 Virus by In Vitro Approaches. *Proceedings* **2023**, *91*, 415. https://doi.org/10.3390/proceedings2023091415

Academic Editors: Sladjana Sobajic and Philip Calder

Published: 15 March 2024

Author Contributions: Conceptualization, E.M.-M., J.P., N.M.R.-M. and Á.A.-S.; methodology, Á.A.-S. and N.M.R.-M.; formal analysis, Á.A.-S. and N.M.R.-M.; investigation, Á.A.-S., N.M.R.-M., J.P. and E.M.-M.; resources, Á.A.-S. and N.M.R.-M.; writing—original draft preparation, Á.A.-S.; writing—review and editing, E.M.-M., J.P., N.M.R.-M.; supervision, E.M.-M. and J.P.; project administration, E.M.-M.; funding acquisition, E.M.-M. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Project PECOVID-0200-2020, funded by Consejería de Salud y Consumo de la Junta de Andalucía and cofunded by the European Regional Development Fund (ERDF-FEDER).

Data Availability Statement: This research was conducted using experimental data. Data can be obtained upon contacting the researchers.

Conflicts of Interest: The authors declare no conflict of interest.