

# Iota-carrageenan neutralizes SARS-CoV-2 and inhibits viral replication in vitro

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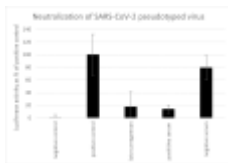
## Abstract

In the absence of a vaccine and other effective prophylactic or therapeutic countermeasures the severe acute respiratory syndrome-related coronavirus 2 (SARS-CoV-2) remains a significant public health threat. Attachment and entry of coronaviruses including SARS-CoV-2 is mainly mediated by the spike glycoprotein. Here, we show that iota-carrageenan can inhibit the cell entry of the SARS-CoV-2 spike pseudotyped lentivirus in a dose dependent manner. SARS-CoV-2 spike pseudotyped lentivirus particles were efficiently neutralized with an IC50 value of 2.6 µg/ml iota-carrageenan. Experiments with patient isolated wild type SARS-CoV-2 virus showed an inhibition of replication in a similar range. In vitro data on iota-carrageenan against various Rhino- and endemic Coronaviruses showed similar IC50 values and translated readily into clinical effectiveness when a nasal spray containing iota-carrageenan demonstrated a reduction of severity and duration of symptoms of common cold caused by various respiratory viruses. Accordingly, our in vitro data on SARS-CoV-2 spike pseudotyped lentivirus and replication competent SARS-CoV-2 suggest that administration of iota-carrageenan may be an effective and safe prophylaxis or treatment for SARS-CoV-2 infections.

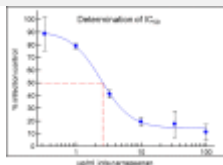
## Conflict of interest statement

The authors have read the journal's policy and declare that the authors Andreas Grassauer, Eva Prieschl-Grassauer, Philipp Graf, and Martina Morokutti-Kurz are employed by Marinomed Biotech AG. Andreas Grassauer and Eva Prieschl-Grassauer are co-founders of Marinomed Biotech AG. Andreas Grassauer, Eva Prieschl-Grassauer and Martina Morokutti-Kurz are inventors of a patent submission related to the content of the manuscript; the number of this patent application is EP20186334. Several over-the-counter products containing iota-carrageenan are available in 40 countries under different brand names. For these products Marinomed Biotech AG declares a financial interest. This does not alter the authors' adherence to all the PLOS ONE policies on sharing data and materials.

## Figures

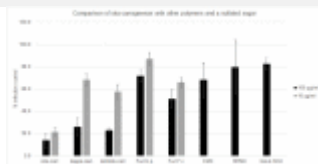


**Fig 1. Neutralization of SARS-CoV-2 pseudotyped lentivirus.**

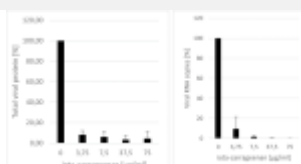


**Fig 2. Determination of IC<sub>50</sub>.**

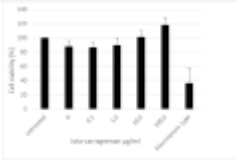
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**Fig 3. Comparison of Iota-carrageenan with other...**



**Fig 4. Iota-carrageenan restricts replication of SARS-CoV-2...**



**Fig 5. Influence of carrageenan on the...**

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