

Pairing Human Skin RNases with Alcohol to Reduce Coronavirus Infection Rate

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ABSTRACT

The ongoing outbreak of the novel coronavirus in China is associated with an alarming occurrence of pneumonia in infected people, while also resulting in substantial economic losses. The author proposes a preventative approach against coronaviruses to decrease the infection rate. Using concentrated human skin RNases along with ethanol or isopropanol to clean hands, as well as the skin around the nose, mouth, and eyes, would substantially reduce the chance for these RNA viruses to enter the human body.

KEYWORDS: Human skin RNases; RNase A superfamily; Ethanol; Isopropanol; Coronaviruses

SHORT COMMUNICATION

Among RNA viruses, the respiratory viruses such as the influenza viruses and coronaviruses are highly contagious. The ongoing outbreak of the novel coronavirus (2019-nCoV) in China is associated with an alarming occurrence of pneumonia in infected people, which has contributed to the shutdown of numerous large cities, and to substantial economic losses. So far, no vaccines or antiviral drugs have been approved as effective against 2019-nCoV. Chinese people were instructed to stay at home during the extended spring festival holiday season, to wear a mask when they have to go outside, to keep at least one or two meters from each other, and to clean their hands with hand sanitizer and/or soap more often than usual. These preventive approaches are aimed at controlling the number of new infections.

Coronaviruses are spherical viruses with an envelope covering their nucleocapsids-the viral capsid proteins associated with single-stranded ribonucleic acid (RNA) genomes [1]. The envelope and the capsid proteins are sensitive to various chemical and physical factors such as acids, solvents (e.g., ethanol, isopropanol), surfactants, and low moisture conditions. Therefore, the use of a

hand sanitizer that contains at least 70% ethanol or isopropanol is an effective way to disrupt the envelopes and nucleocapsids of coronaviruses.

After the disruption of the envelopes and viral capsids, the large RNA genomes of coronaviruses can be released from the virions and stick to the surface of human skin. These RNAs can remain intact even after alcohol treatment and may find a way to gain entry into the body. Humans have an innate cutaneous defense system against viruses and other microorganisms; our skin RNases are one of the important barriers, as their ribonucleolytic activities prevent the entry of exogenous RNAs by cleaving RNA genomes into small pieces, which deactivates them [2].

Among the eight catalytically active members in the RNase A superfamily, RNases 1, 4, 5, and 7 are expressed in human keratinocytes [3-5]. RNase A specifically cleaves at the 3' side of a pyrimidine (uracil or cytosine) [6]. However, previous studies have demonstrated that human skin RNases specifically cleave cytosine residues [2,7,8]. RNase A exhibits high thermal stability due to the existence of multiple disulfide bonds, which allows it to retain its

Quick Response Code:



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Received: February 10, 2020

Published: February 14, 2020

How to cite this article: Bin Wang. Pairing Human Skin RNases with Alcohol to Reduce Coronavirus Infection Rate. 2020 - 2(1) OAJBS.ID.000141. DOI: [10.38125/OAJBS.000141](https://doi.org/10.38125/OAJBS.000141)

ribonuclease activity even at high temperatures (e.g., above 100 °C, while 56 °C is the temperature that deactivates coronaviruses). In addition, RNase A retains its enzymatic activity in 80% ethanol or isopropanol [6,9,10].

In addition to the members of RNase A superfamily, other human skin proteins, such as desquamins, also display ribonuclease activity [11]. To the author's knowledge, no study has investigated human skin RNases, as a whole or individually, for their ability to retain their ribonucleolytic activity under high temperature and high alcohol conditions. The author proposes that human skin RNases are, at least, partially active under high temperature and high alcohol conditions since members of RNase A superfamily share a common three-dimensional conformation and mechanism of action.

Köten et al. [12] determined the secretion level of RNase 7 at different skin areas on healthy volunteers. They found that RNase 7 is expressed all over human skin, but that expression levels vary by site. For example, there are 0.93 ng/cm² of RNase 7 on the forehead, 2.0 ng/cm² on the hand, and 3.4 ng/cm² on the calf of a healthy volunteer [3,12]. The expression level of other human skin RNases at various places on the body has not been studied. In addition, no study has investigated how the expression level of human skin RNases changes in response to a change in the environmental concentration of RNA viruses. The author believes that it is necessary to apply a higher concentration of RNases around the nose, mouth, and eyes to prevent the entry of RNA viruses into human body during an outbreak of respiratory viruses.

Human skin RNases cannot directly act on RNAs inside an intact coronavirus because the RNA is protected by an envelope and nucleocapsid proteins. Since ethanol and isopropanol can denature these proteins and expose viruses' RNA genomes, the author proposes an antiviral approach that combines the actions of both human skin RNases and alcohols.

A sample protocol would be to first select an area of skin that is not normally exposed to air, for example, the upper arm or leg. Check to make sure the skin is intact, then carefully clean it with soap and water. Next, add distilled water or purified water to the cleaned skin surface; the amount of water added depends on how much is necessary to cover that area without allowing the water to run off the skin. After three to five minutes, scrape the skin RNase-containing water to a clean container. Repeat the above steps several times by choosing different skin areas, combining the collected water. Boil the combined RNase-containing water for five to ten minutes, but do not allow the entire solution to evaporate. Boiling not only concentrates the skin RNases, which allows a higher RNA-cleaving capability per unit of solution, but also kills any bacteria and viruses remaining in solution. After boiling, cool the skin RNase-containing water to room temperature, measure its volume, and then mix it with the amount of 90-100% ethanol or isopropanol that results in a final solution that is approximately 75% alcohol (i.e., ~25% skin RNase-containing water mixed with

~75% alcohol by volume). This solution can then be sprayed onto a clean facial tissue and used to wipe hands, and to wipe around the nose, mouth, and eyes, especially after visiting public places.

In summary, the author proposes a preventive approach that can be used by the general public against the current outbreak of coronaviruses. Using enriched human skin RNases in a solution with a final concentration of 75% ethanol/isopropanol to clean hands, and the skin around the nose, mouth, and eyes, should substantially reduce the ability of these RNA viruses to enter the human body.

ACKNOWLEDGMENT

This work is supported by the National Science Foundation under Award No. OIA-1458952. Any opinions, findings and conclusions expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.

DATA AVAILABILITY STATEMENT

All data generated and analyzed during this study are included in this published article.

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