

# Researchers develop potential oral treatment for COVID-19

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Eugenol, an oily liquid extracted from cloves and a Southeast Asian plant known as holy basil, has been effective in treating mice infected with COVID-19 in a laboratory study, according to newly published research

results in the *Journal of Neuroimmune Pharmacology*.

"Eugenol binds to the spike [protein](#) of coronavirus, preventing it from attaching to [healthy cells](#) and entering them," said Kalipada Pahan, Ph.D., the Floyd A. Davis, MD, Professor of Neurology at Rush University Medical Center and director of the laboratory that conducted the study. "This new intervention has been effective in reducing fever and inflammation in the lungs, and has improved [heart function](#) and locomotor functions, in our mouse models."

Holy basil, or tulsi, has a long history of medicinal use and is known to boost immunity that may help fight viral, bacterial and fungal infections.

"Due to its healing power, it is often referred to as an 'elixir of life,'" Pahan said. "Therefore, we screened different components of tulsi leaf."

SARS-CoV-2, the virus that causes COVID-19, binds to an enzyme called ACE2 to enter and infect human cells. One potential approach to treating the disease would be with a molecule that will bind to SARS-CoV-2, but not ACE2, since ACE2 is a beneficial protein.

The research team purchased [various tools](#) formed by laboratory methods including the COVID-19 spike proteins and human cells expressing ACE2 protein. First, they performed an AlphaScreen based assay, a technology that studies biomolecular interactions, to screen different drugs present in tulsi leaf that stops SARS-CoV-2 spike S1 and ACE2 from interacting. Then they performed an in silico analysis, which uses a computer simulation technique that characterizes the properties and structures of a protein.

By applying a protein to protein interaction tool, they found that [eugenol](#) interacted with the residue of the spike S1 protein, not ACE2. To confirm the finding further, they employed the thermal shift assay, a

measurement of the melting temperature of a protein, involving eugenol with either spike S1 protein or ACE2. And they examined whether eugenol prevented the pseudo SARS-2 virus from entering into human cells.

Mice were given the created SARS-CoV-2 spike S1 intranasally and starting from day five. When mice exhibited fever, they received oral treatment of eugenol for 10 days. One group of mice was intoxicated with SARS-CoV-2 spike S1, but not treated with eugenol. They assessed the effect by monitoring fever, the level of proinflammatory cytokines in lungs and serum, heart functions with non-invasive ECG, and locomotor activities with EthoVision XT video tracking software.

"In doing this research, we found that eugenol, but not other major components of holy basil (for example ursolic acid, oleanolic acid and beta-caryophylline), prevented the binding of SARS-CoV-2 spike S1 to the enzyme ACE2 and blocked the entry of SARS-CoV-2 into healthy cells," Pahan said. "Interestingly, we found that eugenol binds with SARS-CoV-2 [spike](#) S1, but not ACE2, a healthy and beneficial protein."

Pahan notes that steroids, which have been used to reduce inflammation in patients with COVID-19, also suppress the immune system. "This could be a new way to prevent the virus from invading healthy cells with the added benefit of decreasing inflammation without the use of anti-inflammatories such as steroids," he says.

**More information:** Ramesh Kumar Paidi et al, Eugenol, a Component of Holy Basil (Tulsi) and Common Spice Clove, Inhibits the Interaction Between SARS-CoV-2 Spike S1 and ACE2 to Induce Therapeutic Responses, *Journal of Neuroimmune Pharmacology* (2021). [DOI: 10.1007/s11481-021-10028-1](https://doi.org/10.1007/s11481-021-10028-1)

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