

DRAFT

Bromelain for Coronavirus

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Author Note

I am currently being home-schooled during the 2020 Coronavirus Pandemic. My Mom, Natasha Savage, assigned me to study Integrative Therapies for Coronavirus for my science studies. She has researched bromelain after trying it for different things and has given it to my brother and I for flu bugs, so it seemed like a good topic to study during the pandemic. She helped find resources, organize material and prepare this document with me using an APA format as best we could for now to try and help me get ready for college.

Here, we show that there are treatments on the shelf already that would be safe to test on people with CoV-2 and include studies that show they have already been proven to be safe and effective for the same symptoms that Covid patients experience. The majority of the discussions here are written by microbiologists and researchers with their own labs and backgrounds in medicine and microbiology. As a student, I am just trying to learn about the sciences through these topics and found that this enzyme should be considered right

away for Covid-19. It is now well over two months into the quarantine for us and we greatly look forward to the end of the pandemic. We do not have connections to labs or researchers, but hope that some labs are studying this enzyme as the research included here holds such promise for this virus.

Abstract

Covid-19 is spreading throughout the globe at a rapid pace. It has taken tens of thousands of lives and hurt so many families within a short period. It has impacted every industry and cost countries trillions in spending. Numerous labs are working for a cure or a vaccine for this virus, but several studies from over the years show a plant enzyme deserves a closer look. This enzyme is widely available, extremely affordable and has been used for different ailments for centuries. As a protein-digesting (proteolytic) enzyme, it dissolves the infective part of the coronaviruses and it balances mammal immune systems so that the body doesn't attack it's own internal organs. Researchers have shown that bromelain helps with the most fatal symptoms of Covid-19. I am not in the medical field, nor do I have a lab at my disposal, but I hope this information gets to someone who is able to invest further research into this enzyme. We should be testing whatever we can right now and since Bromelain has already been used in the medical field, we should study it immediately for Covid-19.

Keywords: bromelain, coronavirus, spike proteins, digestive enzymes

Bromelain Should Be Immediately Studied For Coronavirus

Covid-19 causes four main symptoms that can become fatal, thickening mucus and blood, inflammation and organ failure from immune dysfunction. But there is an enzyme on the shelf that has been shown to be successful in treating all of these symptoms and also has been shown to kill coronaviruses in the lab. Our research shows there is an enzyme from pineapples that dissolves specific proteins that coronaviruses use to hijack host cells and replicate. The enzyme also breaks down proteins that cause blood clotting, lung swelling and respiratory distress in patients and has been shown to balance the immune system and manage cytokine production. Covid patients are dying from over production of cytokines that can lead to death. If it were tested on those infected with CoV-2, then the enzyme could provide relief and it might also dissolve the spike proteins of the virus, as it has for other types of coronaviruses over the years. Further research is needed to test this. The following overview and attached references describe how and why this potential treatment should be considered for this current coronavirus pandemic.

The Covid-19 Pandemic

When did the pandemic begin? In late 2019 doctors in Wuhan, China began to notice respiratory diseases in the hospitals. The virus spread exponentially in Wuhan, and by mid-April of 2020, it had spread rapidly to infect over two million across the globe according to the World Health Organization. ([World Health Organization, 2020](#))

How it spreads? The virus is spread through respiratory droplets when an infected person coughs, sneezes or breathes. Others inhale respiratory droplets, touch surfaces contaminated with the droplets, or touch infected saliva or mucus and then touch their

mouth or nose according to the Centers for Disease Control. ([Centers for Disease Control, 2020](#)) After coming in contact with a host, the coronavirus hijacks the hosts' cells using its spike proteins. The spike proteins are key to the spread of this virus. "The outbreak of a novel coronavirus (2019-nCoV) represents a pandemic threat that has been declared a public health emergency of international concern. The CoV-2 spike (S) glycoprotein is a key target for vaccines, therapeutic antibodies, and diagnostics." Scientists are seeking to design drugs that seek out these spike proteins and block their activity. "In general, by learning what structural features (spike proteins) of viral proteins are most important in establishing contact with human cells," explains University of Minnesota biomedical researcher Fang Li, "we can design drugs that seek them out and block their activity - like jamming their radar." ([Science, 2020](#)).

Bromelain is a protein-digesting enzyme and labs have shown that it removes the crown of spike proteins that makes viruses spread. Since it has been successfully used by scientists to dissolve the spikes of coronaviruses and CoV-2 also infects host cells using the spike proteins, we should begin testing on this enzyme for the Covid-19 pandemic immediately.

Scientific Research on Bromelain for Coronavirus

Where does bromelain come from? The carnivorous pineapple plant produces bromelain to digest insects. Pineapples collect water in their crown of leaves at the top. After an insect falls into the water, it tries to get out and the pineapple excretes bromelain to digest the insect into nutrients.

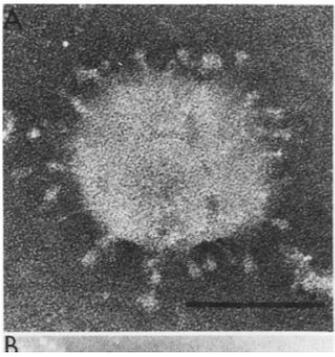
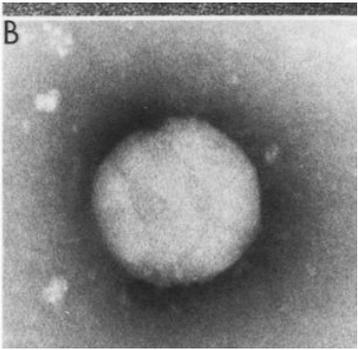
How common is it? This pineapple is of course widely farmed in both tropical and subtropical locations for food markets around the world so it is very common. ([United Nations, 2016](#)) Most of the enzyme is found in the byproduct of pineapple food processing, the stem. It is already available on retail shelves and so it already has manufacturers who are experienced in sourcing and producing this enzyme. Moreover, it has been used safely for centuries in Folk Medicine treating a variety of conditions. According to the National Center for Complementary and Integrative Health, “Historically, Natives of Central and South America used pineapple for a variety of ailments, such as digestive disorders. Currently, bromelain is used as a dietary supplement for nasal swelling and inflammation, osteoarthritis, cancer, poor digestion, and muscle soreness. Topical bromelain is used for wounds and burns.” ([National Center for Complementary and Integrative Health, 2016](#))

What is the dosage? Typically most daily users take one to two 500 mg capsules a day on an empty stomach. Studies show up to 12g daily can be tolerated however. Some patients report relief within an hour and anti-clotting effects were recorded after a single dose. ([Pavan, 2012](#))

What are the side effects? Bromelain has very little, if any, side effects. Most people are not allergic to it and it is very inexpensive. For some patients, it can cause upset stomach, increased heart rate and increased menstrual problems. “Allergic reactions may occur in individuals who are sensitive or allergic to pineapples or who may have other allergies.” ([NCCIH, 2016](#)) An issue of Cell and Molecular Science from August 2001 showed how safe and effective bromelain is orally, “Due to its efficacy after oral administration, its

safety and lack of undesired side effects, bromelain has earned growing acceptance and compliance among patients as a phytotherapeutic drug. A wide range of therapeutic benefits has been claimed for bromelain, such as reversible inhibition of platelet aggregation, angina pectoris, bronchitis, sinusitis, surgical traumas, thrombophlebitis, pyelonephritis and enhanced absorption of drugs, particularly of antibiotics. The claim that bromelain cannot be effective after oral administration is definitely refuted at this time.” (Cell Molecular Life Science, 2001) So overall, if we were to test it on patients, there is a low probability of any harm to the patient and a high probability of therapeutic value.

Can bromelain digest the spike proteins of coronaviruses? Since the sixties, bromelain has been used in labs to dissolve pieces of coronaviruses for researchers to identify their properties and analyze cell functions. Bromelain dissolves the infectious spike protein crown surrounding coronaviruses, so that the surface becomes flat. MacNaughton, Madge, Davies and Dourmashkin studied the effect of Bromelain on Avian Infectious Bronchitis, a type of coronavirus in 1977. “Bromelain treatment of the virus particles was found to remove all of the surface projections but to leave the virus particles otherwise intact,” as shown in the following pictures: ([Journal of Virology, 1977](#))

A coronavirus cell after only 0.07 mg/ml of bromelain	A coronavirus cell after .7mg/ml of bromelain, spikes are gone
	
<p align="center">Polypeptides of the Surface Projections and the Ribonucleoprotein of Avian Infectious Bronchitis Virus</p>	

In 1970, Compans, Dieterklenk, Caligiuri and Purnell researched influenza virions using bromelain to dissect the parts of viral cells in order to examine their properties. This research showed that bromelain's protein digesting properties can dissolve the infectious spike proteins of an influenza coronavirus. It flattened the surface. When it's flat, a coronavirus cell is unable to attach to a host cell to infect the host further.

“Treatment of virions with the protease bromelain degraded the viral spikes resulting in particles which were bounded by a smooth-surfaced membrane, and which could be purified in a potassium tartrate gradient. Such particles were lacking three of the four glycoproteins; the four remaining viral proteins were unaltered by the enzyme. The particles devoid of spikes were noninfective, and they lacked hemagglutinin and neuraminidase activities, indicating that these properties are associated with the spike glycoproteins.” ([Virology, 1970](#))

Bromelain digested enveloped virus proteins again in a 1974 study of another type of enveloped protein virus by Kennedy. It showed the outside of the virus was dissolved by bromelain: “Treatment with bromelain digested the envelope glycoproteins,

destroyed infectivity, hemagglutinating activity and surface antigenicity and yielded a sub-viral particle containing lipid.” ([Journal of General Virology, 1974](#)). And 1985 study by King, Potts and Brian on bovine coronavirus cells showed that bromelain dissolved the spike protein crown of coronaviruses as well. “Bromelain, on the other hand, destroyed the integrity of (spike glycoproteins) gp120, gp100 and gp26.” It should be noted, this study concluded that another protein digesting enzyme, pronase removed the infective spike proteins more than bromelain. ([Virus Research, 1985](#)) but it isn't as readily available as bromelain. Since several studies conducted on the protein-digesting enzyme proved it dissolves the infectious crown of spike proteins, it should be tested on CoV-2 right away.

Does bromelain help relieve coronavirus symptoms? Multiple research studies have shown it helps with severe respiratory infections and blood clotting it and fights inflammation. Further, it balances our immune systems and so may help to prevent Cytokine Storms that become fatal for Covid-19 patients. The research discussions we provide here show that multiple studies should be undertaken right away on this enzyme for treatment and prevention of Covid-19 illnesses and deaths.

How does it help immune systems to prevent death from Cytokine Storms? Aside from killing different coronaviruses, bromelain is known as an immunomodulator and has unique properties that can possibly prevent the fatal cytokine storm that so many Covid patients are dying from. Studies have shown that bromelain regulates the production of pro-inflammatory and anti-inflammatory cytokines. Cytokines are signaling cells the body uses to fight infection. The cytokines can defend too much and begin to attack the

entire system, every organ. A cytokine storm is when a wave of them come to defend your body, even weeks after an infection is eradicated. They can rapidly overwhelm a patients' organs and life.

So not only does the proteolytic enzyme kill coronaviruses in a lab setting, but it helps to balance our immune system by managing cytokines and could prevent the deadly cytokine storm. A cytokine storm is when the immune system attacks a virus, but the cytokines do not get the message that the virus is getting defeated, so they continue to attack. Cytokine storms have been the cause of death for many patients who are otherwise healthy. We hypothesize that bromelain will help with this dangerous condition as it is proven to modulate cytokines. After oral use, bromelain has proven to regulate and balance the cellular responses of cytokines like lymphocytes. ([Phytotherapy Research, 2013](#)) A comprehensive review of studies on Bromelain described how Bromelain acts as an immunomodulator reducing the number of cytokines when our bodies over-produce them and increasing cytokines when needed.

“Bromelain activates the inflammatory mediators, including interleukin (IL)-1 β , IL-6, interferon (INF)- γ and tumor necrosis factor (TNF)- α in mouse macrophage and human peripheral blood mononuclear cells (PBMC) ([20–22](#)). These results indicated that bromelain potentially activates the healthy immune system in association with the rapid response to cellular stress. Conversely, bromelain reduces IL-1 β , IL-6 and TNF- α secretion when immune cells are already stimulated in the condition of inflammation-induced overproduction of cytokines ([23,24](#)). Studies have shown that bromelain reduced the expression of INF- γ and TNF- α in inflammatory bowel disease ([25](#)).” ([Biomedical Reports, 2016](#))

As shown, the enzyme reduces the number of cytokines when there are too many and it increases cytokine production when needed. Further research could show that not only

can it can prevent the deadly Cytokine Storms that patients are dying from in hospitals, but it could prevent deaths at home after the infection has passed.

How else does bromelain help with breathing? Besides balancing our immune systems to fight smarter, the enzyme also fights inflammation so that respiratory patients can breathe easier. Covid patients have trouble breathing because inflammation causes the blood leaking fluid into the lungs. Bromelain helps with breathing from decreasing inflammation and thereby reducing fluid in the lungs and because it thins fluids. The “immune modulating” properties also help decrease swelling throughout the lungs so that air sacs have space to fill with oxygen. Meanwhile, the protein-digesting, mucolytic properties of this enzyme thins mucus so that air sacs are not clogged with thick mucus and so that they can get oxygen to the blood.

How does it help to prevent or treat blood-clotting? Bromelain thins blood to prevent clotting. Infection increases the risk of developing blood clots, scientists suspect it is due to inflammation. Covid patients experience blood clots that may lead to death. A 1980 by GE Felton suggested why a single dose of bromelain helped patients resist thrombosis (blood clotting) for 24 hours. “Since bromelain therapy leads to formation of platelets with increased resistance to aggregation. The combination of fibrinolytic and antithrombic properties appear to be effective and two large scale tests on heart patients have shown a practically complete elimination of thrombosis.” ([Medical Hypotheses, 1980](#)) Bromelain thins blood to prevent clotting, which is a problem for many coronavirus patients. All the more reason to begin tests immediately on this enzyme for Covid patients.

Conclusions

We see that bromelain should be tested right away to find its effects on CoV-2 patients for a possible cure. The protein-digesting enzyme has shown to make several coronaviruses ineffective in the past by dissolving their spike proteins. As a known immunomodulator, it balances the immune system to prevent cytokine imbalances that can become deadly. More importantly, it is known to fight the inflammation that all seriously ill Covid patients experience with swelling and fluid build-up in the lungs. And it thins blood and mucus to prevent blood clots and help with respiratory infections. So overall, it helps with the most serious problems facing Covid patients. Since it is well-tolerated, readily available and has been shown to remove the infectious part of coronaviruses and since it helps patients breathe and helps immune systems gain balance, we should study this enzyme for the Covid-19 pandemic immediately.

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