

Exploring the Therapeutic Uses of Bromelain

Analysis by [Dr. Joseph Mercola](#)

November 25, 2024

STORY AT-A-GLANCE

- › Bromelain, an enzyme found in pineapples, has diverse therapeutic applications including anti-inflammatory, antiviral and anticancer benefits. It also supports digestive and skin health
- › Bromelain effectively manages inflammation in conditions like arthritis and sports injuries by modulating inflammatory mediators and inhibiting the NF- κ B signaling pathway
- › Research shows bromelain has antibacterial properties, inhibiting intestinal bacteria growth and aiding wound healing. It also has antiviral capabilities, particularly against SARS-CoV-2
- › Bromelain exhibits anticancer effects by inducing apoptosis and inhibiting metastasis in various cancer types, including breast, colon, oral and prostate cancers
- › Bromelain supports your cardiovascular health by inhibiting blood platelet aggregation and thrombus formation. It also aids digestive health by promoting beneficial gut bacteria like *Akkermansia muciniphila*

Pineapple is a beloved fruit enjoyed all over the world, known for its sweet, refreshing flavor. Originating from South America, it was first introduced to Europe and Asia by way of Spanish and Portuguese explorers during the 16th and 17th centuries. In Europe, this tropical fruit gained a reputation for being a luxurious dessert.¹

But there's more to pineapple other than just being a delicacy – research shows that bromelain, an enzyme found in pineapple, has several therapeutic applications. As noted in an article² published in The Truth About Cancer, bromelain has documented anti-inflammatory, antiviral and anticancer benefits, and even supports digestive health and skin health.

What Is Bromelain?

The healing properties of pineapple have long been acknowledged by ancient cultures. As noted in a July 2024 Nutrients paper:³

“Indigenous peoples in Central and South America, particularly in regions like the Amazon rainforest and the Caribbean, used various parts of the pineapple plant for medicinal purposes, including treating digestive issues, reducing inflammation, and healing wounds.”

Bromelain was first discovered by Venezuelan scientist Vicente Marciano in 1891, and he was able to extract and study it in 1894.⁴ Other researchers built on his findings and identified two main types – stem bromelain (EC 3.4.22.32) and fruit bromelain (EC 3.4.22.33).⁵ In 1957, it was discovered that pineapple stem contained more bromelain than the fruit, allowing industries to monetize what was once a waste byproduct of pineapple processing.⁶

Research shows that bromelain has an adequate bioavailability rate of 40% when consumed. That's because bromelain efficiently binds with two blood proteases, alpha1-antichymotrypsin, and alpha 2-macroglobulin. Furthermore, the human body is able to handle up to 12 grams of bromelain a day without noticeable side effects.⁷

The U.S. Food and Drug Administration has designated bromelain as a GRAS (generally recognized as safe) substance. It's also available as a dietary supplement, aside from getting it from fresh pineapple.⁸

The Anti-Inflammatory Mechanisms Behind Bromelain

One of the most prominent applications of bromelain is managing inflammation in varied areas, such as arthritis, recovery from sports injuries and postoperative care. How, specifically? The researchers of the Nutrients study explain the mechanisms in their review:⁹

“Bromelain exerts potent anti-inflammatory effects by modulating various inflammatory mediators, including cytokines, chemokines, and prostaglandins. It inhibits the production of proinflammatory cytokines such as interleukin-1 beta (IL-1 β), tumor necrosis factor-alpha (TNF- α), and interleukin-6 (IL-6).

Additionally, bromelain suppresses the nuclear factor-kappa B (NF- κ B) signaling pathway, a key regulator of inflammation and immune responses; by inhibiting NF- κ B activation, bromelain reduces the expression of inflammatory genes and attenuates the inflammatory cascade.”

Given this information, other researchers have tested the anti-inflammatory efficacy of bromelain. In a meta-analysis¹⁰ published in 2022, for example, researchers cited a study involving athletic male road cyclists who supplemented with 1 gram of bromelain per day during a six-day race. They noted that bromelain “reduced subjective feelings of fatigue and there was a trend for better maintenance of the testosterone concentration during the race, suggestive of improved recovery.”

In another study,¹¹ researchers proposed that bromelain has antiarthritic abilities by mediating various inflammatory biomarkers. The results are further improved when combined with other natural bioactive compounds, such as turmeric, to help reduce degenerative joint pain problems. Bromelain also helped relieve other related conditions such as colonic and sinus inflammation.

Bromelain Helps Eradicate Harmful Bacteria

Bromelain has antibacterial properties.¹² Specifically, it’s been shown to be effective in inhibiting the growth of intestinal bacteria, such as vibrio cholera. Moreover, it stops the

enterotoxin production of E. coli and even helps prevent diarrhea caused by this bacterial strain.¹³

Those who are suffering from bacterial skin conditions will benefit from bromelain, too. In the same review, researchers noted it's an effective healing agent for those suffering from pityriasis lichenoides chronica, a skin disease marked by tiny, scaling, raised spots on the skin.¹⁴

Used topically, bromelain will also help heal simple skin wounds. Its antibacterial properties help promote a sterile environment that speeds up healing, thereby reducing the risk of further wound complications.¹⁵

Bromelain Is Also an Effective Antiviral Agent

In a study published in Clinical and Translational Medicine,¹⁶ researchers discovered that bromelain is able to inhibit the spread of SARS-CoV-2. For their tests, they administered bromelain to test cells, noting that it inhibited the expression of the ACE2 receptor and TMPRSS2 protein.

Another noteworthy antiviral capability of bromelain is its ability to “cleave” the spike protein of the SARS-CoV-2 virus. The researchers noted this effect when they administered bromelain directly to test virus samples.¹⁷

For those unfamiliar, spike protein refers to the “spiked” glycoprotein that penetrates host cells, resulting in infection.¹⁸ With the spike protein out of the picture, “viruses like the novel SARS-CoV-2 would not be able to interact with the cells of potential hosts like animals and humans to cause infection,” according to Yale University researcher Benedette Cuffari.¹⁹

“Since bromelain inhibits SARS-CoV-2 infection, and its profound fibrinolytic activity suggests that bromelain or bromelain-rich pineapple could be used as an antiviral against SARS-CoV-2 and future outbreaks of other coronaviruses,” the researchers concluded.²⁰

Combine Bromelain with Quercetin for Greater Antiviral Outcomes

Bromelain is already impressive on its own when it comes to beating viruses. But when combined with quercetin, a potent flavonoid found in various fruits and vegetables, the results are even better, according to published research.

Like bromelain, quercetin has also been extensively studied for its antiviral effects. One study²¹ showed that it inhibits the spread of the flu virus. In another study,²² it was shown to be more effective against Epstein-Barr virus compared to isoliquiritigenin, a bioactive compound found in licorice.²³ Other studies have shown that quercetin is also promising against rhinoviruses,²⁴ which cause the common cold, hepatitis B virus²⁵ and Zika virus.²⁶

Because of the established history of quercetin against viruses, it's natural for other researchers to test its efficacy against a virus that has captured the consciousness of the entire world – SARS-CoV-2. And again, quercetin has shown that it's able to go head-to-head with this virus.

During the early months of the COVID-19 pandemic, a review²⁷ noted that quercetin, alongside the already potent bromelain, plus vitamin C and zinc, “showed promising results in improving clinical outcomes among COVID-19 patients.”

Another study noted that quercetin's ability to inhibit proinflammatory cytokines is one of its ways it's able to fight against SARS-CoV-2.²⁸ Cytokines are small glycoproteins produced in your body and, when released, control varied processes such as endocrine activity and cell proliferation.²⁹ And in the context of COVID-19, cytokines become elevated to the point of causing acute respiratory distress syndrome.³⁰

As for bromelain, it activates your healthy immune system response. It also helps control the production of inflammatory mediators when immune cells are already at work within the context of cytokine overproduction.³¹ Vitamin C and zinc also supports immune function, and these two work with bromelain and quercetin as a novel treatment against COVID-19.³²

Both bromelain and vitamin C also help in the delivery of quercetin into the cells. Since quercetin is generally not soluble in water, it can be poorly absorbed. But, when combined with bromelain or vitamin C, its bioavailability increases, allowing you to maximize its antiviral effect. This creates a synergistic effect because you're getting the nutritional benefits of bromelain and vitamin C at the same time.³³

The Cancer-Fighting Capabilities of Bromelain

Another topic of interest regarding bromelain is its efficacy against cancer. As noted by The Truth About Cancer, "it is believed to inhibit the growth and spread of cancer cells through various mechanisms, including the induction of apoptosis (programmed cell death) and the inhibition of metastasis."³⁴

These mechanisms are observed in different studies, according to the Nutrients meta-analysis.³⁵ In particular, the researchers noted that bromelain has a positive effect against breast and colon cancers:

"In vitro assays have demonstrated that bromelain can induce apoptosis in cancer cells, including breast cancer cells (specifically GI-101A cells). This phenomenon suggests that bromelain may contribute to the inhibition of cancer cell growth and potentially enhance the effectiveness of conventional cancer treatments.

The cytotoxic effects of both unfractionated and fractionated bromelain on colorectal cancer cells have been investigated, alone or in combination with chemotherapeutic agents; the findings indicate that bromelain treatment results in reduced cell survival in colorectal cancer cells in a dose-dependent manner, highlighting its potential as a complementary therapy in colorectal cancer treatment."

It's not just breast and colon cancer that bromelain fights against. In another meta-analysis,³⁶ it's been found to be effective against human oral squamous carcinoma cells. Here, researchers noted that it decreased the cancer cell viability from 95.16% to

69.93% after being treated with bromelain for 24 hours in a dose- and time-dependent manner. In another cited study, bromelain reduced cell viability of prostate cancer cells by 25% using a dose-dependent manner.

Bromelain Supports Healthy Heart Function

Research³⁷ has pointed out that bromelain's anticancer capabilities also have a positive effect in managing cardiovascular health, specifically inhibiting blood platelet aggregation. Bromelain has fibrinolytic activity and inhibits thrombus formation.

Other effects of bromelain on the cardiovascular system include decreasing red blood cell clumping and blood viscosity. The anti-inflammatory capabilities of bromelain also come into play here, as it's been known to be an effective treatment for acute thrombophlebitis,³⁸ a condition wherein a blood clot develops in the legs.³⁹

Bromelain also helps inhibit angina attacks, which help ease hypertension. Through in vivo experiments, it increased "the efficiency of the heart, improves arterial flow, decreases arterial dissections and increases angiogenesis." It even helps improve blood vessel permeability, thereby increasing the distribution of oxygen and nutrients throughout the body.⁴⁰

One More Win for Bromelain – Gut Health

Another reason to add pineapple to your diet is bromelain's ability to support your gut and digestive health. In 2022 animal test⁴¹ published in *Metabolites*, mice fed bromelain had lower populations of proteobacteria, a collection of pathogenic bacterial (such as *Salmonella*, *Helicobacter* and *Escherichia*) strains responsible for a variety of intestinal diseases.⁴²

More importantly, bromelain increased the population of beneficial *Akkermansia muciniphila*, a keystone probiotic that is essential for optimal health.⁴³

As noted in [my interview with Georgi Dinkov](#), Akkermansia supports optimal health because it produces short-chain fats, which are essential nutrients for the endothelial cells in your gut that produce mucin, a thick, protective gel that lines your gastrointestinal tract. This mucin shield protects your gut lining and acts like a repair kit, covering the holes in a leaky gut.

For additional information on just how crucial Akkermansia is for cellular energy and overall health, I encourage you to pick up a copy of my newest book, [“Your Guide to Cellular Health: Unlocking the Science of Longevity and Joy.”](#) The eBook is now available, while the print edition will be available on December 10, 2024.

Sources and References

- ¹ National Library Board Singapore, “Pineapple”
- ^{2, 12, 34} The Truth About Cancer, July 19, 2024
- ³ Nutrients. 2024 Jul; 16(13): 2060, Introduction
- ^{4, 6} Cureus. 2022 Aug; 14(8): e27876, Review
- ^{5, 8} Nutrients. 2024 Jul; 16(13): 2060, Figure 1
- ⁷ Cureus. 2022 Aug; 14(8): e27876, Bioavailability of Bromelain
- ⁹ Nutrients. 2024 Jul; 16(13): 2060, Inflammation, Edema and Swelling
- ¹⁰ Nutrients. 2022 Dec; 14(23): 5069, Bromelain and Other Proteases
- ¹¹ Foods 2021, 10(10), 224, Arthritis
- ¹³ Life (Basel). 2021 Apr; 11(4): 317, Antimicrobial Effect
- ¹⁴ DermNet, “Pityriasis lichenoides”
- ¹⁵ Nutrients. 2024 Jul; 16(13): 2060, Infectious Disorders
- ^{16, 17, 18, 20} Clinical and Translational Medicine, Feb 2021, Volume 11, Issue 2, Letter to Editor
- ¹⁹ News-Medical.net, “What Are Spike Proteins?”
- ²¹ Biomolecules. 2021 Jan; 11(1): 10, Conclusions
- ²² Viruses 2024, 16(1), 124, Natural Extracts Targeting EBV Lytic Infection and Oncogenesis
- ²³ Scientific Reports volume 11, Article number: 23528 (2021), Introduction
- ²⁴ The Egyptian Journal of Bronchology volume 16, Article number: 58 (2022), Methods
- ²⁵ Saudi Pharmaceutical Journal Volume 28, Issue 5, May 2020, Pages 550-559, Abstract
- ²⁶ Int J Mol Sci. 2023 Apr; 24(8): 7504, Abstract
- ²⁷ Research International Journal of Endocrinology and Diabetes, 2020; 1(1), Abstract
- ^{28, 31, 32} Research International Journal of Endocrinology and Diabetes, 2020; 1(1), Discussion
- ²⁹ News-Medical.net, “What Is a Cytokine Storm?”
- ³⁰ Virology Journal volume 19, Article number: 92 (2022), Abstract
- ³³ Interactive Medicine (Fourth Edition), “The Allergic Patient”

- ³⁵ **Nutrients**. 2024 Jul; 16(13): 2060, Cancer
- ³⁶ **Front Oncol**. 2022; 12: 1068778, Cytotoxicity
- ^{37, 38, 39, 40} **Foods** 2021, 10(10), 2249, Effects of Bromelain on Cardiovascular Disease
- ^{41, 43} **Metabolites**. 2022 Nov; 12(11): 1027, Abstract
- ⁴² **Pathogens**, Special Issue Edition