

Bromelain A Wonder Supplement: A Review

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Summary

A substance called bromelain found in Pineapple juice and stem has become a popular nutritional supplement.

Bromelain contains enzymes with a range of potent effects. Bromelain has also been reported to have beneficial effects on the digestive, respiratory and circulatory systems and possibly on the immune system. Bromelain is also used to treat swelling and inflammation following surgery, especially sinus surgery it use as a natural remedy for easing the symptoms of arthritis, including pain and joint stiffness. The present review states the uses of Bromelain in various diseases such as Cancer, Respiratory Conditions, Ulcers etc. and also states the biosynthesis and its mode of action with various Drug interactions.

Keywords: Bromelain, Nutritional supplement , Pineapple juice.

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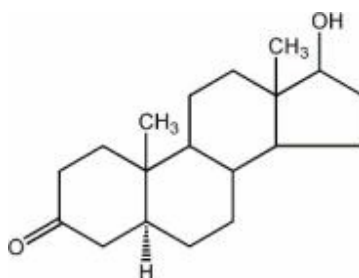
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Introduction

Pineapple is one of the world's most popular tropical fruits. It originated in South America and had been domesticated by Native Americans in the West Indies centuries before Columbus introduced it to Europe after encountering its tangy sweetness on a voyage to the island of Guadeloupe. Now enjoyed on almost every continent, the pineapple has been increasingly recognized for its medicinal properties. Specifically, a substance called bromelain found in its juice and stem has become a popular nutritional supplement. Bromelain contains enzymes with a range of potent effects. One of the most powerful is its ability to reduce inflammation. In 1993, a German government commission approved the use of bromelain to treat swelling and inflammation following surgery, especially sinus surgery. Some studies have supported its use as a natural remedy for easing the symptoms of arthritis, including pain and joint stiffness. Bromelain has also been reported to have beneficial effects on the digestive, respiratory and circulatory systems and possibly on the immune system. One research study even found that bromelain when combined with trypsin eased the pain associated with breast engorgement as a result of nursing. This 21st century research is supported by pineapple's longstanding use by the indigenous people of the Americas, who used the juice as an anti-inflammatory, diuretic and digestive aid. They also drank it to ease sore throats, reduce seasickness and induce labor. And according to folk medicine, its fruit was even used to terminate pregnancies by women who ate the flesh of young, toxic pineapple.¹



History

The first isolation of bromelain was recorded by the Venezuelan chemist Vicente Marciano in 1891 from the fruit of pineapple. In 1892, Chittenden, assisted by Joslin and Meara, investigated the matter fully and called it 'bromelin'. Later the term 'bromelain' was introduced and originally applied to any protease from any plant member of the plant family Bromeliaceae. Bromelain was first introduced as a therapeutic supplement in 1957. Research on bromelain apparently was first conducted in Hawaii but more recently has been conducted in countries in Asia, Europe and Latin America. Germany has recently taken a great interest in bromelain research; bromelain is currently the 13th most widely used herbal medicine in Germany.^{2, 3}

Source

Bromelain is present in all parts of the pineapple plant (*Ananas comosus*), but the stem is the most common commercial source, presumably because it is readily available after the fruit has been harvested. Pineapples have had a long tradition as a medicinal plant among the natives of South and Central America. However, just eating pineapple will not give you a great deal of extra bromelain, because it is most highly concentrated in the stem, which is not nearly as tasty (albeit still edible).⁴

Extract Components

Bromelain extract is a mixture of sulfur-containing protein-digesting enzymes called proteolytic enzymes or proteases and several other substances in smaller quantities. The two main enzymes are:

- Stem bromelain - EC 3.4.22.32
- Fruit bromelain - EC 3.4.22.33

The other substances typically include peroxidase, acid phosphatase, protease inhibitors and calcium.^{5,6}

Absorption and Bioavailability

Bromelain is absorbed through the gastrointestinal tract. It was detected (upto 40%) in blood after oral administration in rats. Bromelain concentration was found highest in the blood after one hour of administration. It is also reported that upto 40% of bromelain is absorbed from the intestine. In an experimental study it determined the half-life (6-9 hrs) and plasma concentration (2.5-4 ng/ ml) of bromelain after oral administration of 8.6 gm each day.⁷

Biosynthesis ^{8,9}

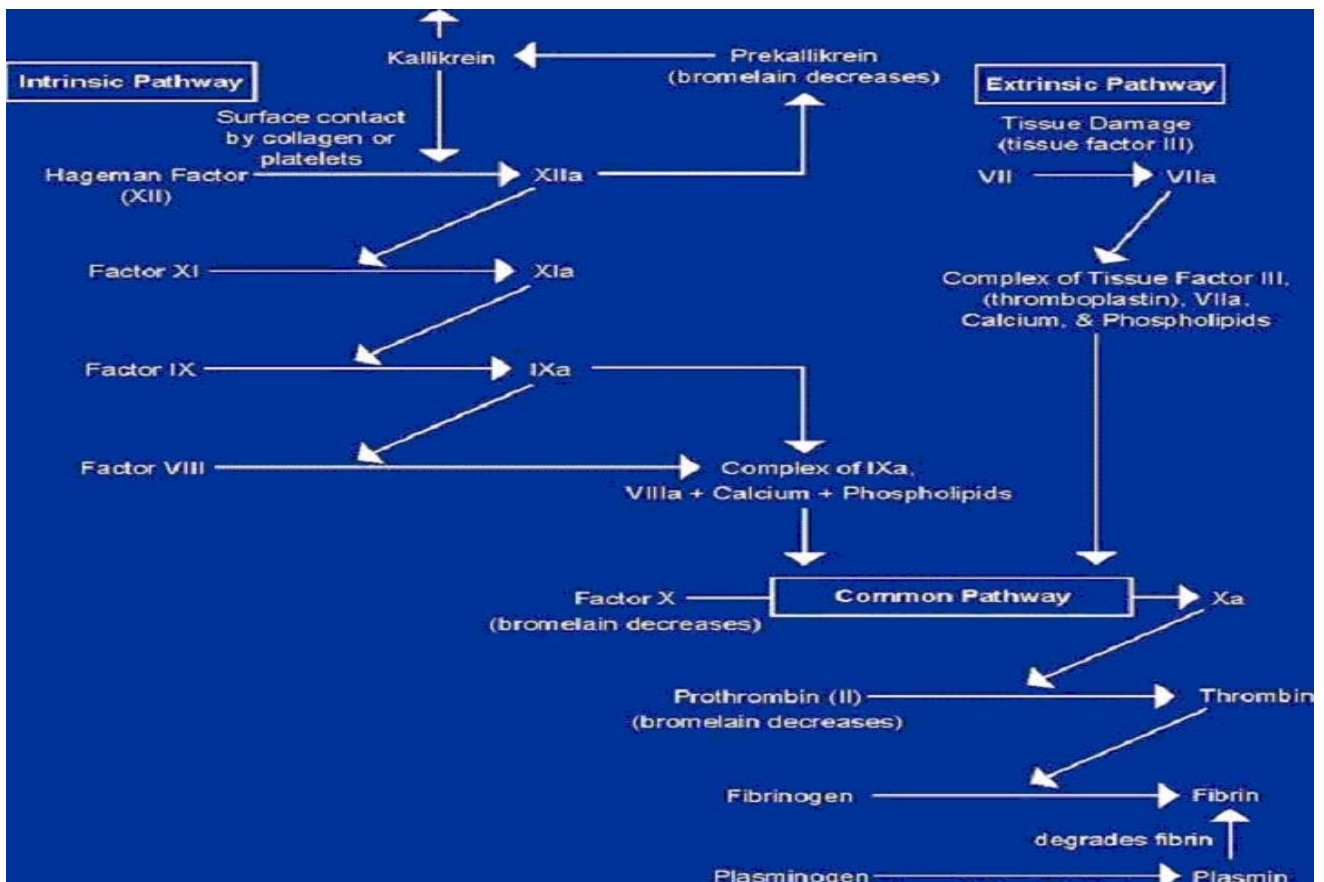


Figure 1: Biosynthesis of Bromelain

Mechanisms of Action

Although pineapples have been part of indigenous America for centuries, the bioactive essence of the plant bromelain was not isolated in chemical form until the late 19th century. In 1957, bromelain was introduced to the market as a therapeutic supplement. Bromelain's potency comes from enzymes, or proteins, that stimulate chemical activity in the body. Bromelain is known as a proteolytic enzyme, which means that it digests proteins (or proteases). Eight different chemicals within bromelain help digest proteins.¹⁰ While inflammation helps heal the body during injury, too much swelling can lead to health complications and accelerate aging. By breaking down fibrins, bromelain is said to help prevent clotting and improve circulation. Similarly, supplement makers claim this enzymatic activity thins the blood, prevents the buildup of plaque in the arteries and slows the coagulation (or clumping) of blood platelets.¹¹ That's why Native Americans used parts of the pineapple plant to dress and treat wounds. Bromelain also slows the accumulation of kinins, another byproduct of inflammation and prostaglandins, hormone-like compounds found throughout the body. Prostaglandins, associated with swelling and clotting at sites of injury, can contribute to the formation of diseases when their presence is excessive. In a five-year study of more than 200 people, bromelain was found to be effective in slowing the growth of inflammatory prostaglandins.¹²

Clinical Indications^{13, 14, 15, 16}

Cancer	Several animal and human studies indicate bromelain might have some antimetastatic ability. In doses over 1,000 mg daily, bromelain has been combined with chemotherapeutic agents such as 5-FU and vincristine, resulting in tumor regression.
Immune Modulation	Bromelain can induce cytokine production in human peripheral blood mononuclear cells. Treatment leads to activation of natural killer cells and to the production of tumor necrosis factor-alpha, interleukin-1-beta and interleukin-6 in a time- and dose-dependent manner. Bromelain has also been shown to remove T-cell CD44 adhesion molecules from lymphocytes and to affect T-cell activation.
Wound Debridement	Bromelain applied topically as a cream (35% bromelain in a lipid base) can be beneficial in the elimination of burn debris and in acceleration of healing. A non-proteolytic component of bromelain is responsible for this effect. This component, referred to as escharase, has no hydrolytic enzyme activity against normal protein substrates or various glycosaminoglycan substrates and its activity varies greatly from preparation to preparation.
Antibiotic Potentiation	Antibiotic potentiation is one of the primary uses of bromelain in several foreign countries. In humans, bromelain has been documented to increase blood and urine levels of antibiotics. Combined bromelain and antibiotic therapy has been shown to be more effective than antibiotics alone in a variety of conditions, including pneumonia, bronchitis, cutaneous Staphylococcus infection, thrombophlebitis, cellulitis, pyelonephritis, perirectal and rectal abscesses and sinusitis.
Respiratory Conditions	In a clinical study of 124 patients hospitalized with chronic bronchitis, pneumonia, bronchopneumonia, bronchiectasis, or pulmonary abscess, those receiving bromelain orally showed a decrease in the volume and purulence of the sputum.

Digestive Aid	Bromelain has been used successfully as a digestive enzyme following pancreatectomy, in cases of exocrine pancreas insufficiency and in other intestinal disorders. The combination of ox bile, pancreatin and bromelain is effective in lowering stool fat excretion in patients with pancreatic steatorrhea, resulting in symptomatic improvements in pain, flatulence and stool frequency.
Ulcers	Bromelain has been reported to heal gastric ulcers in experimental animals. In an extensive study of the effect of bromelain on the gastric mucosa, bromelain increased the uptake of radioactive sulfur by 50 percent and glucosamine by 30-90 percent. Increased uptake of these substances may allow the gastric mucosa to heal more rapidly.
Surgical Procedures and Musculoskeletal Injuries	Bromelain's most common application is in the treatment of inflammation and soft tissue injuries. It has been shown to speed healing from bruises and hematomas Treatment with bromelain following blunt injuries to the musculoskeletal system results in a clear reduction in swelling, pain at rest and during movement and tenderness. Administration of bromelain pre-surgically can reduce the average number of days for complete disappearance of pain and inflammation.
Cardiovascular and Circulatory Applications	Research indicates bromelain prevents or minimizes the severity of angina pectoris. A drastic reduction in the incidence of coronary infarct after administration of potassium and magnesium rotate along with 120-400 mg bromelain per day has been reported. In a study involving 73 patients with acute thrombophlebitis, bromelain, in addition to analgesics, was shown to decrease symptoms of inflammation including pain, edema, tenderness, skin temperature and disability
Osteoarthritis	Bromelain may help with mild pain associated with osteoarthritis. It's a common ingredient in nutritional supplements marketed as a natural pain remedy for arthritis. Large, well-designed studies are needed to see if it is effective and to find out about possible side effects.
Sinusitis	Bromelain has been suggested as a complementary treatment for sinusitis. Preliminary studies suggest that it may help reduce congestion, improve breathing and suppress coughing. It's approved by the Commission E as a complementary treatment for nasal and sinus swelling and inflammation after ear, nose and throat surgery. A review of three small but well-designed previously published studies found that bromelain may help relieve sinusitis symptoms.

Table 1: Clinical Indications of Bromelain**Bromelain and Peyronie's Disease**

Peyronie's Disease, named after the French surgeon who first identified it in the 18th century, is characterized by a severe curvature of the erect penis caused by plaque or a hard lump that forms on the appendage. Peyronie's disease affects more than 1 percent of adult men between the ages of 45 and 60. And in severe cases, the condition causes great pain during erection, making sexual activity

impossible. There is no known cure, but treatment options include three types of surgery. However, none of the surgical options has proven to be consistently successful and can increase the risk of impotence or further deformation of the penis .The cause of Peyronie's Disease is unknown, but the reason it tends to occur in older men is because as we age, the number of enzymes in our body begins to deplete. That's why we tend to lose our hearing, eyesight and memory as we get older. It's also why some men can experience a buildup of scar tissue in their penises, leading to Peyronie's Disease.¹⁷ There simply aren't enough enzymes to breakdown all the plaque and foreign substances that circulate in the blood stream [PDI].The key to bromelain's potential as a natural remedy for Peyronie's Disease is its affect on collagen the primary material in scar tissue. Of all the protein-digesting enzymes, bromelain is most effective at stimulating collagenase, the enzyme that breaks down collagen by dissolving the peptide bonds that hold their proteins together. Taking bromelain may slow or reverse the tissue buildup that causes Peyronie's one more reason never to underestimate the power of pineapple.¹⁸

Side Effects ^{19, 20}

<p>Gastrointestinal Effects</p>	<p>These are the most common bromelain side effects that are experienced by people with overdose of bromelain. These side effects are nausea, vomiting, diarrhea, palpitation, indigestion, loss of appetite, headache, muscle pain, dizziness, drowsiness and lethargy. Women can experience uterine bleeding and heavy menstruation as well. It is also suggested that people with peptic ulcer should not consume bromelain in any form. Also, people with any other digestive disorder should consult the health care provider before using bromelain.</p>
<p>Allergic Reactions</p>	<p>Another major bromelain side effects that are observed amongst bromelain users is, mild to severe sorts of allergies. These are skin allergies and also digestive allergies (mentioned above). Skin allergies include hives, skin rash, itching and swelling of skin. Other than that, a person may also suffer from breathing problems and tightness in throat. People that have allergies from carrot, fennel, celery, rye, papaya, birch or cypress pollen, certain grass or latex, may suffer with bromelain side effects that are similar to the usual side effects they experience.</p>
<p>Heavy Bleeding</p>	<p>Bromelain is theoretically said to increase blood flow. So, people that are suffering with blood disorders or bleeding disorders and taking treatments for the same should not use bromelain, to avoid any bromelain side effects. They are advised to use bromelain only after medical intervention and strict medical supervision. Bromelain should also not be taken two to three weeks prior to any dental operations and surgeries. It is safe not to use bromelain when pregnant and nursing. Also, people that are suffering with liver disease and kidney disease should avoid it.</p>

Table 2: Side effects of Bromelain

Possible Drug and Herb Interactions²¹

People taking "blood-thinners" (anticoagulant or anti-platelet medication), such as aspirin, warfarin (Coumadin), heparin, clopidogrel (Plavix), non-steroidal anti-inflammatory medications such as ibuprofen (Motrin, Advil), naproxen (Naprosyn, Aleve) should only use bromelain under a physician's supervision. It should also be used with caution by people taking herbs and supplements that are thought to increase the risk of bleeding, such as ginkgo biloba and garlic. Studies suggest bromelain may also increase the absorption of other medications, such as:

- Amoxicillin, tetracycline and other antibiotics
- Chemotherapy drugs such as 5-fluorouracil and vincristine
- "ACE inhibitor" blood pressure medications such as captopril (Capoten) and lisinopril (Zestril)
- Medications that cause drowsiness, such as benzodiazepines lorazepam (Ativan) or diazepam (Valium), some antidepressants, narcotics such as codeine and barbituates such as phenobarbitol.

Conclusion

Bromelain is one of the wonder enzyme and nutritional supplement to cure various life threatening diseases. It also works as immuno modulator and hence proved as a gift for one suffering from immuno deficiency disorders. It can be the major nutritional supplement of 21st century.

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