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Medicinal Effects Of Bromelain (Ananas Comosus) As An Anti-Oxidant Agent

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Abstract:
It Has Been Extensively Researched For Its Several Health Advantages. Bromelain Is A Combination Of Enzymes Obtained From The Pineapple Plant (Ananascomosus).Bromelain Has Strong Antioxidant Activity, According To Several Studies. The Scavenging Of Free Radicals, The Suppression Of Lipid Peroxidation, And The Modulation Of Antioxidant Enzyme Activity Are Only A Few Of The Methods By Which It Exerts Its Antioxidant Effects. It Has Been Discovered That Bromelain Is An Efficient Scavenger Of Reactive Oxygen Species (ROS), Including Superoxide Anions, Hydroxyl Radicals, And Hydrogen Peroxide, Avoiding Oxidative Damage To Biological Components.The Medicinal Effects Of Bromelain As An Antioxidant Have Been Explored In Several Disease Models. Studies Have Demonstrated Its Potential Therapeutic Applications In Conditions Characterized By Oxidative Stress, Including Cardiovascular Diseases, Neurodegenerative Disorders, And Inflammatory Conditions. Bromelain's Antioxidant Properties Have Also Shown Promise In Wound Healing, Reducing Inflammation, And Supporting Immune Function.

Key Words: *Bromelain, Antioxidant, Oxidative Stress, Therapeutic Application*

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I. INTRODUCTION

The medicinal potential of bromelain is strong, and it contains a variety of proteinase inhibitors. Using ultrafiltration, centrifugation, and lyophilization to create a yellow powder from the juice of cooled pineapple, it is made. Various pH levels can affect the success of this process[1,2].

Many chemical substances, such as Na2S, H2S, sodium cyanide, CaCl2, and others, stimulate the action of bromelain; however, some of these substances, such as Ag+, Hg2+, Cu2+, and iodoacetate, can hinder proteolytic activity [3]. There are various benefits to the extraction and purification of bromelain [4].It also inhibits bacterial enterotoxin production [5].

Osteoarthritis, dental plaque, and gingivitis are all conditions that bromelain treats. It also enhances the healing properties of several antibiotics, such as tetracycline and amoxicillin. It is approved as a complimentary therapeutic treatment for sinus and nasal edoema and appears to be a key mucolytic treatment for rhinitis, rhinosinusitis, and severe rhino-nausea. In addition to treating pain from an episiotomy, bromelain has also been successfully utilised to treat perineal, arthritic, and muscle discomfort.Bromelain has been shown to be beneficial in treating gastric ulcers in animals [6].

It can be used to lower the risk of death in persons with Peyronie's disease. Inhibiting the initial stages of the metastatic process, bromelain can be useful in the treatment of cancer. It does this by selectively cleaving a cluster of differentiation 44 (CD44) molecules. Bromelain has been shown to have antidiarrheal properties and is thought to be a crucial supplement for the treatment of diarrhoea [7].

A polymer that is water soluble and capable of undergoing chemical transformation is bromelain. Modern medical therapy has greatly benefited from the use of nanoparticles in pharmaceutics [8].

Nausea, vomiting, diarrhoea, palpitations, indigestion, loss of appetite, headaches, muscle discomfort, dizziness, drowsiness, and lethargy are the most typical side effects of bromelain overdoses. Additionally, excessive menstruation and uterine haemorrhage can happen [9],[10],[11].

Chemistry and Biochemical Properties of Bromelain

Thiol endopeptidase is one of the enzymes included in bromelain, which also contains phosphatase, peroxidase, glycoprotein, and carbohydrate. Through extraction techniques, it is produced from the pineapple stem and incipient fruits. The outcome is a crude, aqueous extract from the Bromeliaceae family.[12],[13],[14].

It is undeniable that bromelain has great therapeutic potential and is rich in proteinase inhibitors [2],[3].When bromelain is extracted from cooled pineapple juice using various techniques such as ultrafiltration, centrifugation, and lyophilization, a yellow powder is created. Gelatin, chromogenic tripeptides, and casein are just a few of the substrates used by bromelain's proteolytic activity, which breaks down proteins to produce various amino acids, including tyrosine, alanine, and lysine [15].Additionally, mackerel hydrolysis has been reported to benefit from the application of bromelain [16].Bromelain can function in a wide pH range, however its ideal pH range is 5.5-8 [13]. Numerous chemicals work as stimulators to aid in the action of bromelain, such as Na2S, H2S, sodium cyanide, and CaCl2. On the other hand, a few can inhibit the proteolytic activity of bromelain, including Ag+, Hg2+, Cu2+, and iodoacetate [3].

Therapeutic Efficacy of Bromelain

A protease enzyme, found in pineapples, is the enzyme that separates other proteins by severing their amino acid chains. Furthermore, bromelain is a cysteine protease, which means that it disassembles proteins wherever they contain the cysteine amino acid [17]. The pineapple protease bromelain, through indirect action, specifically blocks the formation of pro-inflammatory prostaglandins.

Medical Uses

According to clinical research, bromelain may be useful in the treatment of a number of illnesses.

Effect of Bromelain on Cancer Cells

According to recent research, bromelain has the ability to alter crucial pathways that encourage cancer. Bromelain's anti-cancerous properties are likely a result of how it affects cancer cells and their surrounding environment, as well as how it affects the immunological, inflammatory, and hemostatic systems [18].On mouse and human cells, both malignant and normal, treated with bromelain preparations, the majority of in vitro and in vivo investigations on the anticancer activity of bromelain are focused. In a study done by Beez et al., chemically produced mouse skin papillomas were given bromelain treatment, and the researchers saw a decrease in tumour volume and apoptotic cell death. [19].

Role of Bromelain in Surgery

The usual time it takes for pain and postoperative inflammation to completely go can be lowered by taking bromelain before surgery. According to studies, bromelain may help women who are having episiotomies feel less discomfort, bruising, and swelling. Today, sports injuries and acute inflammation are both treated with bromelain [20], [21], [22].

Effects of Bromelain on Diarrhea

According to evidence, certain intestinal infections including Vibrio cholera and Escherichia coli, whose enterotoxin causes diarrhoea in animals, are affected differently by bromelain. Intestinal secretory signalling mechanisms such as adenosine 3′:5′-cyclic monophosphatase, guanosine 3′:5′-cyclic monophosphatase, and calcium-dependent signalling cascades appear to interact with bromelain to produce this effect [23].

Bromelain Relieves Osteoarthritis

In Western nations, osteoarthritis is the most prevalent type of arthritis; prevalence rates in the USA range from 3.2 to 33% dependant on the joint [24]. In 103 patients with knee osteoarthritis, diclofenac was compared against a mixture of bromelain, trypsin, and rutin.Both therapies reduced the pain and inflammation significantly and similarly after six weeks [25]. Nonsteroidal anti-inflammatory drugs (NSAIDs) may not be the only therapy option, according to a dietary supplement called bromelain [21]. It is crucial to the pathophysiology of arthritis [26].

Effect of Bromelain on Immunogenicity

The use of bromelain as an adjuvant therapy strategy has been suggested for the management of autoimmune, neoplastic, and chronic inflammatory illnesses [27].Additionally, there is proof that bromelain oral treatment has some analgesic and anti-inflammatory benefits in people with rheumatoid arthritis, one of the most prevalent autoimmune illnesses [28].

Effect of Bromelain on Blood Coagulation and Fibrinolysis

By enhancing serum fibrinolytic activity and preventing the formation of fibrin, a protein involved in blood clotting, bromelain affects blood coagulation [29]. The amount of bromelain needed to lower the serum fibrinogen level in rats varies. Both prothrombin time (PT) and activated partial thromboplastin time (APTT) are

noticeably prolonged at greater bromelain concentrations [30]. Studies conducted in vitro and in vivo have revealed that bromelain is a potent fibrinolytic agent because it promotes plasminogen to plasmin conversion, which increases fibrinolysis by breaking down fibrin [31, 32].

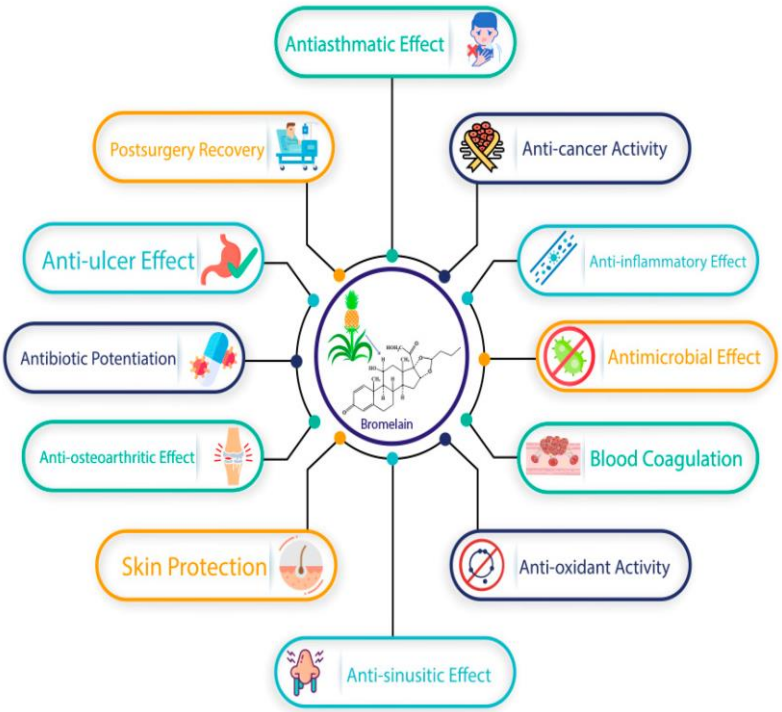

Fig 1 Leipner, J., Iten, F., & Saller, R. (2001). Therapy with proteolytic enzymes in rheumatic disorders. *BioDrugs, 15,* 779-789.

II MATERIAL & METHODS

MATERIAL

The pineapples (Ananascomosus), variety "Kew", used in this study and purchased from the local market.

METHODS

Clean, unblemished pineapple fruits peels were cut into thin pieces. The weighed mass was 700 gm. The juice was extracted using grinder in the food science laboratory BBAU, Lucknow after blending the mixture was filtered using cheese cloth, after that partial purification of bromelain was done using ammonium sulfate precipitation(NH4)2SO4. Centrifugation was done at 10,000g for 15 minutes to pellet out protein. Pooled and dissolved pellets obtained at three stages in PBS and moved to the next step to further dialyze out the Ammonium Sulfate. After centrifuging, the supernatant was collected and store at - 20°C

Determination of Antioxidants:

Antioxidant properties can be found in bromelain powder. The best method for determining an object's antioxidant capacity is DPPH [33]. As antioxidative substances scavenge DPPH free radicals, the sample's colour shifts from purple to yellow. Figure 2 shows the characteristics of antioxidants. By using a spectrophotometer, the optical density of a sample and the optical density of the control can be calculated to determine DPPH value a sample.

According to the Blois (1958) approach, the methanol extract from an energy bar was tested for its capacity to scavenge free radicals.

The free RSA of the energy bar was tested using a 1,1- diphenyl

- 2-picryl hydrazyl (DPPH) technique. A total of 24 milligrams of DPPH were dissolved in 100 mL of methanol for making the stock solution. Filtration ofDPPH stock solution using methanol yielded a usable mixture with an absorbance of around 0.973 at 517 nm. In a test tube, 3 mL DPPH workable solutions were combined with 100 µL of energy bar and methanol solution.
- Four different concentration of energy bar ranging from 10^{-1} to 10^{-4} were prepared for antioxidant analysis in methanol.
- Three milliliters of solution containing DPPH in 100 µL of methanol is often given as a standard. After that,

the tubes were kept in complete darkness for 30 min. The absorbance was therefore determined at 517 nm. The following formula was used to compute the percentage of antioxidants.
% Of antioxidant activity= [(Ac−As) ÷Ac] × 100
where: Ac—Control reaction absorbance; As—Testing specimen absorbance.

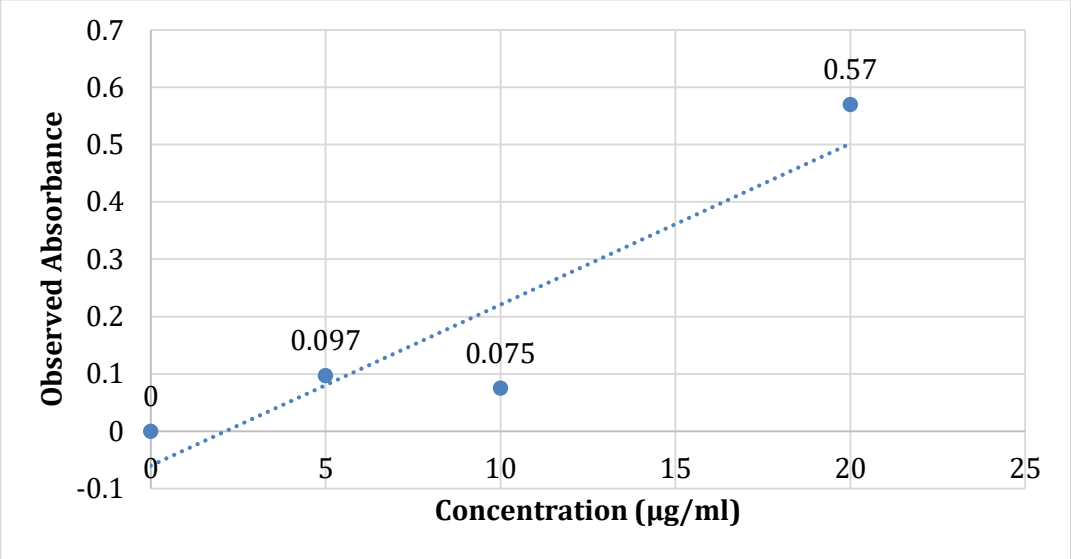

Fig: 2 Shows DPPH activity of bromelain powder

Table1: Concentration DPPH activity of bromelain powder

Tube code	S.NO.	Concentration (µg/ml)	Observed Absorbance
Blank	1	0	0
S1	2	5	0.097
S2	3	10	0.075
S3	4	20	0.57

IV. CONCLUSION

As an antioxidant, bromelain from Ananascomosus shows promise medical benefits. Its potential therapeutic uses are aided by its anti-inflammatory, antioxidant, immune-modulating, digestive, and wound-healing characteristics. To validate and completely comprehend the scope of these effects, as well as to establish the ideal dosage and treatment regimens, more research—including clinical trials—is nevertheless required.

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REFERENCES

[1]. Hatano, K. I., Kojima, M., Tanokura, M., & Takahashi, K. (1996). Solution Structure of Bromelain Inhibitor VI from Pineapple Stem: Structural Similarity with Bowman− Birk Trypsin/Chymotrypsin Inhibitor from Soybean. Biochemistry, 35(17), 5379-5384.
[2]. Tayab, M. A., Chowdhury, K. A. A., Jabed, M., Mohammed Tareq, S., Kamal, A. M., Islam, M. N., ...&Simal-Gandara, J. (2021). Antioxidant-rich woodfordiafruticosa leaf extract alleviates depressive-like behaviors and impede hyperglycemia. Plants, 10(2), 287.
[3]. Mamo, J., &Assefa, F. (2019). Antibacterial and anticancer property of bromelain: a plant protease enzyme from pineapples (Ananascomosus). Curr. Trends Biomed. Eng. Biosci, 19, 60-68.
[4]. Manzoor, Z., Nawaz, A., Mukhtar, H., &Haq, I. (2016). Bromelain: Methods of extraction, purification and therapeutic applications. Brazilian Archives of Biology and Technology, 59.
[5]. Mynott, T. L., Ladhams, A., Scarmato, P., &Engwerda, C. R. (1999). Bromelain, from pineapple stems, proteolytically blocks activation of extracellular regulated kinase-2 in T cells. The Journal of Immunology, 163(5), 2568-2575.
[6]. Manzoor, Z., Nawaz, A., Mukhtar, H., &Haq, I. (2016). Bromelain: Methods of extraction, purification and therapeutic applications. Brazilian Archives of Biology and Technology, 59.

[7]. Tochi, B. N., Wang, Z., Xu, S. Y., & Zhang, W. (2008). Therapeutic application of pineapple protease (bromelain): a review. Pakistan journal of nutrition, 7(4), 513-520.

[8]. Ataide, J. A., Gérios, E. F., Mazzola, P. G., &Souto, E. B. (2018). Bromelain-loaded nanoparticles: A comprehensive review of the state of the art. Advances in Colloid and Interface Science, 254, 48-55.

[9]. Dighe, N. S., Pattan, S. R., Merekar, A. N., Laware, R. B., Bhawar, S. B., Nirmal, S. N., ... &Musmade, D. S. (2010). Bromelain a wonder supplement: A review. Pharmacologyonline, 1(2), 11-8.

[10]. Munzig, E., Eckert, K., Harrach, T., Graf, H., & Maurer, H. R. (1994). Bromelain protease F9 reduces the CD44 mediated adhesion of human peripheral blood lymphocytes to human umbilical vein endothelial cells. FEBS letters, 351(2), 215-218.

[11]. Jyoti, M. A., Barua, N., Hossain, M. S., Hoque, M., Bristy, T. A., Mahmud, S., ...&Simal-Gandara, J. (2020). Unravelling the biological activities of the Byttneriapilosa leaves using experimental and computational approaches. Molecules, 25(20), 4737.

[12]. Bhattacharyya, B. K. (2008). Bromelain: an overview.

[13]. Pavan, R., Jain, S., & Kumar, A. (2012). Properties and therapeutic application of bromelain: a review. Biotechnology research international, 2012.

[14]. Dutta, T., Paul, A., Majumder, M., Sultan, R. A., &Emran, T. B. (2020). Pharmacological evidence for the use of Cissusassamica as a medicinal plant in the management of pain and pyrexia. Biochemistry and Biophysics Reports, 21, 100715.

[15]. Hidayat, M., Prahastuti, S., Wargasetia, T. L., Nugraha, K., Soemardji, A. A., Rahmawati, S. F., ...& Hasan, K. (2019). Green peas protein hydrolyzed by bromelain in simple procedure to improve kidney function in cisplatin-induced rats. Journal of Reports in Pharmaceutical Sciences, 8(1), 68.

[16]. Steinkraus, K. H. (1976). The use of bromelain in the hydrolysis of mackerel and the investigation of fermented fish aroma. Int. J. Food Sci. Technol, 11, 379-388.

[17]. Abreu, D. C., &Figueiredo, K. C. D. S. (2019). Bromelain separation and purification processes from pineapple extract. Brazilian Journal of Chemical Engineering, 36, 1029-1039.

[18]. Chobotova, K., Vernallis, A. B., & Majid, F. A. A. (2010). Bromelain's activity and potential as an anti-cancer agent: current evidence and perspectives. Cancer letters, 290(2), 148-156.

[19]. Báez, R., Lopes, M. T., Salas, C. E., & Hernández, M. (2007). In vivo antitumoral activity of stem pineapple (Ananascomosus) bromelain. Planta medica, 73(13), 1377-1383.

[20]. Tassman, G. C., Zafran, J. N., &Zayon, G. M. (1964). Evaluation of a plant proteolytic enzyme for the control of inflammation and pain. J Dent Med, 19, 73-77.

[21]. Brien, S., Lewith, G., Walker, A., Hicks, S. M., & Middleton, D. (2004). Bromelain as a treatment for osteoarthritis: a review of clinical studies. Evidence-based complementary and alternative medicine, 1(3), 251-257.

[22]. Howat, R. C. L., & Lewis, G. D. (1972). The effect of bromelain therapy on episiotomy wounds—a double blind controlled clinical trial. BJOG: An International Journal of Obstetrics & Gynaecology, 79(10), 951-953.

[23]. Mynott, T. L., Guandalini, S. T. E. F. A. N. O., Raimondi, F. R. A. N. C. E. S. C. O., & Fasano, A.L.E.S.S.I.O. (1997). Bromelain prevents secretion caused by Vibrio cholerae and Escherichia coli enterotoxins in rabbit ileum in vitro. Gastroenterology, 113(1), 175-184.

[24]. Lawrence, R. C., Helmick, C. G., Arnett, F. C., Deyo, R. A., Felson, D. T., Giannini, E. H., ... & Wolfe, F. (1998). Estimates of the prevalence of arthritis and selected musculoskeletal disorders in the United States. Arthritis & Rheumatism: Official Journal of the American College of Rheumatology, 41(5), 778-799.

[25]. Akhtar, N. M., Naseer, R., Farooqi, A. Z., Aziz, W., &Nazir, M. (2004). Oral enzyme combination versus diclofenac in the treatment of osteoarthritis of the knee–a double-blind prospective randomized study. Clinical rheumatology, 23, 410-415.

[26]. Mojcik, C. F., &Shevach, E. M. (1997). Adhesion molecules. A rheumatologic perspective. Arthritis & Rheumatism: Official Journal of the American College of Rheumatology, 40(6), 991-1004.

[27]. Barth, H., Guseo, A., & Klein, R. (2005). In vitro study on the immunological effect of bromelain and trypsin on mononuclear cells from humans. European journal of medical research, 10(8), 325.

[28]. Leipner, J., Iten, F., & Saller, R. (2001). Therapy with proteolytic enzymes in rheumatic disorders. BioDrugs, 15, 779-789.

[29]. Lotz-Winter, H. (1990). On the pharmacology of bromelain: an update with special regard to animal studies on dose-dependent effects. Plantamedica, 56(03), 249-253.

[30]. Livio, M., Bertoni, M. P., &DeGaetano, G. (1978). Effect of bromelain on fibrinogen level, prothrombin complex factors and platelet aggregation in the rat: A preliminary report. Drugs Exp. Clin. Res, 4, 49.

[31]. De-Giuli, M., &Pirotta, F. (1978). Bromelain: interaction with some protease inhibitors and rabbit specific antiserum. Drugs ExpClin Res, 4, 21-23.

[32]. Taussig, S. J., &Batkin, S. (1988). Bromelain, the enzyme complex of pineapple (Ananascomosus) and its clinical application. An update. Journal of ethnopharmacology, 22(2), 191-203.

[33]. Tripathi, S., & Mishra, S. (2021). Antioxidant, antibacterial analysis of pectin isolated from banana peel and its application in edible coating of freshly made mozzarella cheese. Asian Food Science Journal, 20(7), 82-92.