Pineapple as an Inflammation Curator

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Abstract— **Man is said to be a frugivorous and a frugivorous human is generally defined as one that lives on fruits. There are many reasonins for according pre eminent position to fruits. Eating fruits provides health benefits people who eat more fruits and vegetables as part of an overall healthy diet are likely to have a reduced risk of some chronic diseases. Fruits provide vital nutients for health and maintenance of body. Fruits are full of all nurtients most fruits are naturally low in fat, sodium and calorie. Pineapple belongs to the order Bromeliales, family Bromeliaceae, subfamily Bromeliaceae, Pineapple is used as food as well a medicine also. Pineapple contains vitamins such as vitamin A, B1, B2, Niacin, vitamin C and chlorine. Pineapple is great source of antibacterial Bromelian is anty inflammatory. The use of this fruit is valuable in arthritis and rheumatic affiliations. Fresh pineapple juice reduce the swelling & inflammation both in osteoarthritis and rheumatoid arthritis, an exclusive diet of fresh pineapple juice for few days, and repeated at regular intervals, will help in relieving symptoms of these diseases.Pineapple and its compounds have been linked to many health benefits, including aiding digestion, boosting immunity and speeding up recovery from surgery, among others**.

Index Terms— **Ananas, Pine apple, anti inflammatory antibacterial Bromelain, Wound healing, debridement**

I. INTRODUCTION

The pineapple is a delicious and healthful fruit..There was a time when it was a rare table delicacy in Europe and could be purchased only by the rich. It is now widely cultivated in India Malay States, East and south Africa, West Indies, Cuba ,Jamaica, Brazil and tropical America(Tysser 1947- 48).The Juice materially aids in the digesting of proteins both animal and vegetable. It has been found that fresh pineapple juice is a constant and powerful digestant of albuminous matter, acting in both alkaline and acidic media, but is more energetically neutral than in either of the others. Osteoarthritis is the most common form of arthritis in western countries in U.S.A. Prevalence of osteoarthritis ranges from 3.2 to 33% dependent on the joint (Lawrence et. al., 1998). Combination of Bromelain of Pine apple, trypsin and rutin was compared to diclofence in 103 patients with osteoarthritis of knee. After six weeks, both treatments resulted in significant and similar reduction in the pain and inflammation (Akhtar et. al., 2004). Bromelainof Pineapple is food supplement that may provide alternate treatment to no steroidal anti inflammatory drug (NSAIDS). (Brien et. al., 2004). Bromelain of Pineapple plays an important role in the pathogenesis of Arthritis. (Mojac & ,Shevach ,1997). Bromelain of Pineapple has a analgesic properties which are thought to be the result of its direct influence on pain mediators such as bradykinin (Bodi, 1966 and Kmakura et. al., 1988). The earliest reported studies investigating Bromelain were a series of case reports on 28 patients with moderator severe rheumatoid or osteoarthritis.(Cohen and Goldman , 1964).

The acid content of the fruit is also important from the nutritional point of view. The pineapple is pre-eminently a citric fruit in as much as about 87% of its acid ae formed by citric acid and only 13 % by Malic acid.(.Both these acids are easily absorbed by the body and help to produce heat and energy (Ibid, 1954). Bromelain of Pineapple which resembles pepsin to a considerable extent and help to digest meat, white of egg, casein of milk, fish and beans.(Bailey and .Bailey, 1928). Fresh pineapple juice exercises a soothing effect on the throat. It is supposed to be useful in preventing affections of the vocal organs. It highly esteemed by the singers, who often take it for maintaining the health of the throat, In diphtheria it is used as a mouth wash for removing the dead membranes from the throat. (An Indian dietarian – Food and nutrition in India page 191 Calcutta).

II. ORIGIN AND AND DISTRIBUTIIONON

The Pineapple (comosus) belonging to the family bromeliacease is one of the few monocototyledonous fruit like banana. It is a native of Brazil and has reached India by1548, the name of the pineapple is associated with Hawaii and Singapore, but its cultivation in these places developed around the turn off century. Columbus encountered the pineapple in1493 on the leeward island of Guadeloupe. He called it pine de indes meaning pine of Indians. The South American Guarani Indians called it nana meaning excellent fruit and cultivated them for food (Fruits, 1969).

III. PLANT DESCRIPTION

Pine apple is grown on various types of the soil in different parts of the world, including very poor soils. In fact, the quality of fruit grown on light soil is considered to be superior. In India sandy and loamy soils and the latrite soils on the hilly slopes in south India have been found very suitable. In several parts of the world where the soil is alkaline or contains an excess of element manganese, the plants are unable to absorb sufficient iron from the soil. Salts of iron are to be sprayed on the leaves of the plant under these conditions. The most important variety in India is the Giant knew or smooth cayenne. It has ash-greyleaves with smooth margins, large fruits with an average weight of 3 to 4 kg.

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Mauritius is the second most important variety. The average size of its fruit is 1.5 to 2.5 kg. The pineapple plant is terrestrial herb 2.5 to5 ft high with a spread of 3 to 4ft (Fruits, 1969).

IV. CLASSIFICATION (BOTANICAL DESCRIPTION)

Official latin Name: Ananas canme from guarani word Nana meaning fragrant excellent fruit
Botanical Name : Ananas Comosus
Scientific Name : Ananas Comosus
Common Name : Pine apple
Family : Bromeliaceae
Genus : Ananas Cosmosus
Species : Ananas Comosus
Flowering time: Jan. to March
(FAO, 2009. FAOSTAT Database. Rome, Italy: FAO. http://www.fao.org/faostat/en/#home.

V. FOOD VALUE (CHMICAL CONSTITUTES)

All values are per 100 grams edible portion. The pineapple is highly esteemed for its high minerals and vitamin contents

FOOD VALUE OF PINEAPPLE

Moisture : 87.8 gm, Protein : 0 .4gm, Fat : 0 .1 gm.

Minerals : 0.4 gm, Fibre : 0 .5 gm , Carbohydrate : 10.8 gm

Calorific value: 46 Kcal. Calcium: 0.20mg, Phosphorus: 0.9mg,

Iron : 2.42mg

MINERALS, AND VITAMINS

All values are mg per 100gms

MINERALS		VITAMINS		
Magnicium	33	Vitamin A	Carotene	18
Sodium	34.7	Vitamin B	Thiamine	0.20
Pottacium	37		Riboflavin	0.12
Copper	0.13		Niacin	0.1
Mangnese	0.56	Vitamin C		39
Zinc	0.11	Choline		8
Cromium	0.011			
Sulpher	20			
Chlorine	13			

OXALIC ACID, PHYTIN AND PHOSPHORUS CONTENTS

All values are mg per 100gms

Oxalic Acid	5	Phytin	2	Phytin P as percent of total P	22

(Nutritive value ofIndian foods by C Gopalan and Rama Shastri and balasubrmaniam published by National institute of Nutrition , Indian council ofmedical research Hydrabadfirs edition 1971 Reprinted 1994 page 55, 72, 65, 91

VI. PHYSICAL AND CHEMICAL PROPERTES OF PINEAPPLE

The quiality of the pineappleis determined by the sugar it contains. Generally 8 to 15% of sugar is found in the fruit or the average may be taken as 12 percent. About 4%of the sugar of the pine apple is constituted by glucose and other easikly assimilable sugars and 7.5% by cane sugar (L.H Burkil M.A- F L S 1935)
The lower part of the fruit contains more sugar than the upper half. It may also be noted that the fruitis most sweet during the summer.Sugar contents of the pineapple is highestwhen it is ripe. During the later stages of ripening the sugar content of the fruit is increasesfrom 4 percent 15 percent within 2 weeks (W.B. Hags 1945) . Larger pineapples ar e sweeter than than smaller ones and the ratio of glucose t sugar is higher in bigger varieties. (Andrews. L.Winton 1946)

VII. BROMELAIN OF PINEAPPLE

A wide range of therapeutic benefits have been claimed for bromelain so as Pineapple , such as reversible inhibition of platelet aggregation, sinusitis, surgical traumas (Livio M, Gaetano GDe, Donati MB. 1978). thrombophlebitis, pyelonephriti angina pectoris, bronchitis (Neubauer RA.1961) and enhanced absorption of drugs, particularly of antibiotics (Renzini G, Varego M.Die 1972, Maurer HR. Bromelain: 2001) Several studies have been carried out indicating that bromelain has useful phytomedical application. However, these results are yet to be amalgamated and critically compared so as to make out whether bromelain will gain wide acceptance as a phytomedical supplement(Tochi BN, Wang Z, Xu SY, Zhang W **2008)** . Bromelain acts on fibrinogen giving products that are similar, at least in effect, to those formed by plasmin (Taussig S .J. **1980**). Experiment in mice showed that antacids such as sodium bicarbonate preserve the proteolytic activity of bromelain in the gastrointestinal tract(Hale L.P. **2004)**. Bromelain is considered as a food supplement and is freely available to the general public in health food stores and pharmacies in the USA and Europe (Ley CM, Tsiami A, Ni Q, Robinson N.**2011)**. Existing evidence indicates that bromelain can be a promising candidate for the development of future oral enzyme therapies for oncology patients**. (**Chobotova K, Vernallis AB, Majid FAA.**2011)**. Bromelain can be absorbed in human intestines without degradation and without losing its biological activity (Chobotova K, Vernallis AB, Majid FAA.**2010 and** Castell JV, Friedrich G, Kuhn CS, Poppe GE. **1997)**

Medicinal Uses Clinical studies have shown that bromelain may help in the treatment of several disorders.

VIII. EFFECTS OF BROMELAIN OF PINEAPPLE ON CARDIOVASCULAR AND CIRCULATION

Bromelainof Pineapple pre ents or minimizes the severity of angina pectoris and transient ischemic attack (TIA). It is useful in the prevention and treatment of thrombophlebitis. It may also break down cholesterol plaques and exerts a potent fibrinolytic activity. A combination of bromelain and other nutrients protect against ischemia/reperfusion injury in skeletal muscle.(Neumayer C, Fügl A, Nanobashvili J, et al. **2006)** . Cardiovascular diseases (CVDs) include disorders of

the blood vessels and heart, coronary heart disease (heart attacks), cerebrovascular disease (stroke), raised blood pressure (hypertension), peripheral artery disease, rheumatic heart disease, heart failure, and congenital heart disease .(World Health Organization. **2011)** . Stroke and heart disease are the main cause of death, about 65% of people with diabetes die from stroke or heart disease. Bromelain of Pineapple has been effective in the treatment of CVDs as it is an inhibitor of blood platelet aggregation, thus minimizing the risk of arterial thrombosis and embolism (Heinicke RM, van der Wal L, Yokoyama M. **1972)** . King et al. reported that administration of medication use to control the symptoms of diabetes, hypertension, and hypercholesteromia increased by 121% from 1988–1994 to 2001–2006 ($P < 0.05$) and was greater for patients with fewer healthy lifestyle habits. Bromelainof Pineapple supplement could reduce any of risk factors that contribute to the development of cardiovascular disease(King DE, Ellis TM, Everett CJ, Mainous AG**. 2009)** . In a recent research, Bromelain of Pineapple was found to attenuate development of allergic airway disease (AAD), while altering $CD4^+$ to $CD8^+$T lymphocyte populations. From this reduction in AAD outcomes it was suggested that bromelainof Pineapple may have similar effects in the treatment of human asthma and hypersensitivity disorders.(Secor ER, Jr., William FC, Michelle MC, et al. 2005). In another study, carried out by Juhasz et al., Bromelain ofPineapple was proved to exhibit the ability of inducing cardioprotection against ischemia-reperfusion injury through Akt/Foxo pathway in rat myocardium. (Juhasz B, Thirunavukkarasu M, Pant R, et al. **2008)**

IX. Effect of Bromelain of Pineapple on Immunogenicity

Bromelainof Pineapple has been recommended as an adjuvant therapeutic approach in the treatment of chronic inflammatory, malignant, and autoimmune diseases. **(**Barth H, Guseo A, Klein R**. 2005)** Bromelain of Pineapple can block the Raf-1/extracellular-regulated-kinase- (ERK-) 2 pathways by inhibiting the T cell signal transduction .(Mynott TL, Ladhams A, Scarmato P, Engwerda CR. **1999)**. Treatment of cells with bromelain of Pineapple decreases the activation of CD4 (+) T cells and reduce the expression of CD25**.(** Secor ER, Jr., Singh A, Guernsey LA, et al. **2009)**. Moreover, there is evidence that oral therapy with bromelain of Pineapple produces certain analgesic and anti-inflammatory effects in patients with rheumatoid arthritis, which is one of the most common autoimmune diseases . **(**Leipner J, Iten F, Saller R**.2002).**

X. Efect of Bromelain of Pineapple on Blood Coagulation and Fibrinolysis

Bromelain of Pineapple influences blood coagulation by increasing the serum fibrinolytic ability and by inhibiting the synthesis of fibrin, a protein involved in blood clotting **(**Livio M, De Gaetano G, Donati MB. **1978.** In rats, the reduction of serum fibrinogen level by bromelain of Pineapple is dose dependent. At a higher concentration of bromelain, both prothrombin of Pineapple time (PT) and activated partial thromboplastin time (APTT) are markedly prolonged. **(**Livio M, De Gaetano G, Donati MB. **1978.)** *In vitro* and *in vivo* studies have suggested that bromelain of Pineapple is an effective fibrinolytic agent as it stimulates the conversion of plasminogen to plasmin, resulting in increased fibrinolysis by degrading fibrin.**(** De-Guili M, Pirotta F.**1978,** Taussig SJ, Batkin S **1988).**

XI. Effects of Bromelain of Pineapple on Diarrhea

Evidence has suggested that bromelain of Pineapple counteracts some of the effects of certain intestinal pathogens like *Vibrio cholera* and *Escherichia coli,* whose enterotoxin causes diarrhoea in animals. Bromelain of Pineapple appears to exhibit this effect by interacting with intestinal secretory signaling pathways, including adenosine 3′ : 5′-cyclic monophosphatase, guano sine 3′ : 5′-cyclic monophosphatase, and calcium-dependent signaling cascades.**(** Mynott TL, Guandalini S, Raimondi F, Fasano **1997)**. Other studies suggest a different mechanism of action. In *E. coli* infection, an active supplementation with bromelain leads to some ant adhesion effects which prevent the bacteria from attaching to specific glycoprotein receptors located on the intestinal mucosa by proteolytically modifying the receptor attachment sites .**(** Chandler DS, Mynott TL.**1998,** Mynott TL, Luke RKJ, Chandler DS. **1996)**

XII. Effect of Bromelain of Pineapple on Cancer Cells

Recent studies have shown that bromelain of Pineapple has the capacity to modify key pathways that support malignancy. Presumably, the anti cancerous activity of bromelain of Pineapple is due to its direct impact on cancer cells and their microenvironment, as well as on the modulation of immune, inflammatory, and haemostatic systems .(Chobotova K, Vernallis AB, Majid FAA. 2010). Most of the *in vitro* and *in vivo* studies on anticancer activity of bromelain of Pineapple is concentrated on mouse and human cells, both cancerous and normal, treated with bromelain preparations. In an experiment conducted by Beez et al chemically induced mouse skin papillomas were treated with bromelain and they observed that it reduced tumor formation, tumor volume and caused apoptotic cell death.(Béez R, Lopes MTP, Salas CE, Hernández M. 2007) . Bromelain of Pineapple is found to increase the expression of p53 and Bax in mouse skin, the well-known activators of apoptosis. (Béez R, Lopes MTP, Salas CE, Hernández M.2007) . It is considered that inhibiting NF-κB, Cox-2, and PGE2 activity has potential as a treatment of cancer. Bromelain of Pineapple was found to down regulate NF-κB a.(Béez R, Lopes MTP, Salas CE, Hernández M.2007) nd Cox-2 expression in mouse papillomas. (Béez R, Lopes MTP, Salas CE, Hernández M. 2007) . Bromelain of Pineapple markedly has *in vivo* anti tumoral activity for the following cell lines: P-388 leukemia, sarcoma (S-37), Ehrlich ascetic tumor, Lewis lung carcinoma, and ADC-755 mammary adenocarcinoma. In these studies, intraperitoneal administration of bromelain after 24 hours of tumour cell inoculation resulted in tumour regression . (Béez R, Lopes MTP, Salas CE, Hernández M.2007.

XIII. Role of Bromelain of Pineapple in Surgery

Administration of bromelain of Pineapple before a surgery can reduce the average number of days for complete disappearance of pain and postsurgery inflammation Tassman GC, Zafran JN, Zayon 1964, Tassman GC, Zafran JN, Zayon GM. 1965.). Trials indicate that bromelainof Pineapple might

be effective in reducing swelling, bruising, and pain in women having episiotomy .(Howat RCL, Lewis GD 1972)

XIV. Role of Bromelain of Pineapple in Debridement Burns

The removal of damaged tissue from wounds or second/third degree burns is termed as debridement. Bromelain of Pineapple applied as a cream (35% bromelain in a lipid base) can be beneficial for debridement of necrotic tissue and acceleration of healing. Bromelain of Pineapple contains escharase which is responsible for this effect. Escharase is nonproteolytic and has no hydrolytic enzyme activity against normal protein substrate or various glycosaminoglycan substrates. Its activity varies greatly with different preparations.(Houck JC, Chang CM, Klein G.1972) . In two different enzymatic debridement studies carried out in porcine model, using different bromelain-based agents, namely, Debriding Gel Dressing (DGD) and Debrase Gel Dressing showed rapid removal of the necrotic layer of the dermis with preservation of the unburned tissues (Rosenberg L, Krieher Y, Silverstain E, et al 2012., Singer AJ, McClain SA, Taira BR, Rooney J, Steinhauff N, Rosenberg L. Rapid 2019) . In another study on Chinese landrace pigs, enzymatic debridement using topical bromelain of Pineapple in incised wound tracks accelerated the recovery of blood perfusion, pO_2 in wound tissue, controlled the expression of TNF-α, and raised the expression of TGT-β .) Wu SY, Hu W, Zhang B, Liu S, Wang JM, Wang AM. 2012) Enzymatic debridement using bromelain of Pineapple is better than surgical debridement as surgical incision is painful, nonselective and exposes the patients to the risk of repeated anaesthesia and significant bleeding (Hu W, Wang AM, Wu SY, et al. 2011 , Miller JG, Carruthers HR, Burd DAR 1992, Sheridan RL, Tompkins RG, Burke JF.1994 . Salisbury RE. In-thermal burns. In: McCarthy JC 1990)

XV. Toxicity of Bromelain of Pineapple

According to Taussig et al.(Taussig SJ, Yokoyama MM, Chinen A.1975). Bromelain has very low toxicity with an LD_{50} (lethal doses) greater than 10 g/kg in mice, rates, and rabbits. Toxicity tests on dogs, with increasing level of bromelain of Pineapple up to 750 mg/kg administered daily, showed no toxic effects after six months. Dosages of 1500 mg/kg per day when administered to rats showed no carcinogenic or teratogenic effects and did not provoke any alteration in food intake, histology of heart, growth, spleen, kidney, or hematological parameters . (Moss IN, Frazier CV, Martin GJ 1963) .

Conclusion

Bromelainof Pine apple has a wide range of therapeutic benefits, but the mode of its action is not properly understood. It is proved that bromelainof Pineapple is well absorbed in body after oral administration and it has no major side effects, even after prolonged use. All the evidences reviewed in this paper suggest that bromelainof Pine apple can be used as an effective health supplement to prevent osteoarthritis of knee, cancer, diabetes, and various cardiovascular diseases in the long run.

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