

# Phytochemicals found in the tropical pineapple



**ASSIGN  
BUSTER**

Pineapple can be eaten both fresh and processed although the proteolytic protein bromelain will degrade if it is processed, this means that if tinned pineapple is used to make jelly it will set, but if fresh pineapple is used the jelly will not set, also if you use fresh pineapple to cook your ham steaks it will help to tenderise the meat. Phenolic compounds in the pineapple were tested using the pineapple juice and one measurement taken used the TRAP assay (total radical-trapping antioxidant potential) {{27 Swatsitang, Prasan Unknown}}.

Bromelain is made from the cooled pineapple juice that has gone through centrifugation, ultrafiltration and lyophilisation to produce a powder {{18 Maurer, H. R. 2001}}. This powder can then be taken in tablet form with good efficacy, is non toxic, does not have any side effects therefore it can be taken for prolonged periods of time and in high doses of around 750mg per day. A dose should be taken about one hour before meals {{25 Chobotova, Katya 2010; 18 Maurer, H. R. 2001}}

Diet and lifestyle can play an important role in both the contributory effect and prevention of disease as well as genetics and environmental factors {{13 Willett, W. C. 2002}}. It is well known that the food we eat produces free radicals which in normal homeostatic states the free radicals are produced and destroyed naturally {{24 Temple, Norman J. 2000}}, when the production of free radicals becomes a problem damage to DNA replication, and lipid and protein production can cause a number of degenerative diseases and body dysfunction that can include an impaired immune system, cancer, diabetes, atherosclerosis, chronic heart disease. These oxidative stressor states can be counteracted by eating fruit and vegetables high in

antioxidants such as Vitamin C, Vitamin E and  $\beta$  carotene and also the phytochemicals and nutrients found in the foods we eat {{27 Swatsitang, Prasan Unknown; 24 Temple, Norman J. 2000}}.

Research into the phenolic content of some common fruits, including pineapple, found that the different phenols (bound and soluble free) were able to produce activity in different areas of the gastrointestinal system. Bound phenols (caffeic acid, ferulic acid, and p-coumaric acid) had the ability to reach the colon in contrast to the soluble free phenols that are digested earlier in the digestive system by the stomach or small intestine. This might therefore suggest that different sites in the gastrointestinal system would benefit from the bioactivity of phenols {{12 Sun, Jie 2002; 29 Goldberg, Gail Dr (editor) 2003}}.

The levels of antioxidant and anti-proliferant activity are measured per  $\mu\text{mol}$  of Vitamin C equivalent of a gram of fresh weight fruit: the highest levels were found in cranberry with  $177.0 \pm 4.3 \mu\text{mol/g}$  and pineapple at  $16.9 \pm 0.3 \mu\text{mol/g}$ . Pineapple had no anti-proliferant activity {{12 Sun, Jie 2002}}. Vitamin C is considered the major antioxidant in fruits and vegetables and although cranberries have the highest antioxidant level there is very little Vitamin C contained therein. Therefore it might be considered that antioxidant performance is not just that of Vitamin C but also phenolic content{{12 Sun, Jie 2002; 27 Swatsitang, Prasan Unknown}}. Sun, Li and associates experimented with the bound and free phenolics in eleven common fruits: the highest total of free and bound phenolics (expressed as mg of gallic acid equivalent to 100g fresh fruit) was cranberry ( $527.2 \pm 21$ .

5mg/100g) with pineapple somewhere in the middle of the table ( $94.3 \pm 1.5$  mg/100g) and grapefruit the lowest performer ( $49.6 \pm 2.6$  mg/100g).

In a more detailed search of phenolic acids that are found in pineapple, the juice was measured and similar findings regarding phenolic content and vitamin C were discussed: ferulic acid, p-Coumaric acid, Caffeic acid, Vanillic acid, p-Hydroxybenzoic acid were all found in pineapple {{27 Swatsitang, Prasan Unknown}}. Ferulic acid (3-methoxy-4-hydroxycinnamic acid) is a by-product of cinnamic acid and a precursor to vanillic acid, vanillin being a catabolic product of ferulic acid degradation {{28 Sahelian, Ray Dr 2005}}. The ferulic acid structure has a phenolic nucleus and side chain therefore producing a good quality stable phenoxy radical (a free radical with a unpaired oxygen atom) with great antioxidant potential. This free radical once catalyzed with UV gives it the ability to scavenge free radicals and also the ability to suppress “ radiation-induced oxidative reactions {{28 Sahelian, Ray Dr 2005}}”. It might therefore be said that ferulic acid may help keep cell integrity intact once they have been exposed to exogenous pollutants (air, cigarette smoke) and UV radiation {{28 Sahelian, Ray Dr 2005; 24 Temple, Norman J. 2000}}.

Coumaric acids are hydroxal derivatives of cinnamic acid, which includes p-coumaric acid (4CA) and caffeic acid {{29 Goldberg, Gail Dr (editor) 2003}}. The phytochemical p-coumaric may inhibit the homeostatic process of glyconeogenesis which may therefore have implications for insulin resistant type diabetes, where glucose is continually generated even though glucose levels are high {{30 Lima, Leonardo C. N. 2006}}.

Further p-coumaric acid has also been shown in research to inhibit platelet aggregation without effecting blood coagulation {{31 Luceri, Cristina 2007}}. The data suggested that “ 4CA is an antioxidant compound with good anti-platelet activity at doses that can be obtained with dietary intervention, suggesting possible applications for primary prevention of vascular disease” {{31 Luceri, Cristina 2007}}. Chlorogenic acid is the ester of caffeic acid with the 3-hydroxyl group of quinic acid and antioxidant and therefore these two may contribute to the prevention of cardiovascular disease {{32 Olthof, Margreet R. 2001}}. Caffeic acid has been known to show anti-carcinogenesis effects as well as immunomodulatory, anti-inflammatory {{32 Olthof, Margreet R. 2001}}.

As far back as 1988 Taussig and other recognised the significance of bromelain, found in pineapples, as anti-coagulant and anti-metastatic compound {{23 Taussig, Steven J. 1988}}. He feed bromelain to mice and found a 77-98% reduction in the subcutaneous Lewis lung tumour cells. Since 1988 many of the bioactive qualities of bromelain have been listed: it has been suggested that it can modulate tumour growth, blood coagulation, produces inflammatory changes and may help in the absorption of drugs and the debridement of third degree burns {{23 Taussig, Steven J. 1988}}. Maurer in 2001 agrees with Taussig citing both proteolytic activity and non-proteolytic activity in having the same effects {{18 Maurer, H. R. 2001}}.

The protease components of bromelain have also been attributed to anti-cancer activity {{25 Chobotova, Katya 2010}} although it has also been suggested that the use of bromelain for the treatment of inflammation, suppressed immunity and haemostasis irregularities are just as important for <https://assignbuster.com/phytochemicals-found-in-the-tropical-pineapple/>

the research into the implications of carcinogenesis. Evidence in-vivo showed tumour reducing effects when bromelain was given to mice. The effects produced on skin papillomas were to reduce the formation and volume of the tumour and to cause apoptotic cell death and some evidence of reducing metastasis and growth of the cancer cells Kalra et al in {{25 Chobotova, Katya 2010}}.

Research undertaken on human glioblastoma cells found that bromelain “reduced the adhesion and migration of cells also reduced the invasive capacity of the glioblastoma cells {{25 Chobotova, Katya 2010}}” but when compared with mouse cells it was found the bromelain did not affect the glioma cell growth or the DNA profile. The question that was then asked was bromelain action specific to certain cell/cancer types? Was Bromelain more effective on some cancers than others? Tysnes et al in {{25 Chobotova, Katya 2010}}.

Chronic inflammation contributes to the formation of cancer therefore if chronic inflammation can be controlled could not the formation of cancer be reduced. It is suggested that if the key activities of NF- $\kappa$ B, Cox-2 and PGE2 could be inhibited this may potentially become a treatment for cancer and chronic inflammation. Bromelain has been shown to downgrade NF- $\kappa$ B and Cox-2 in mouse papillomas and in models of skin tumour development. Additionally in some human cancer types bromelain has been shown to reduce the activity of NF- $\kappa$ B, Cox-2 and PGE2. The molecular mechanisms that have this effect are still unknown {{25 Chobotova, Katya 2010; 18 Maurer, H. R. 2001}}. Some of the regulators that are connected with NF- $\kappa$ B are IFN $\gamma$ , TNF- $\alpha$ , IL-1 $\beta$  and IL-6 which can be affected by the presence of <https://assignbuster.com/phytochemicals-found-in-the-tropical-pineapple/>

Bromelain and that in a healthy immune system will provide a quick response to any cellular stress and in immunocompromised systems bromelain reduced the effect of the regulators {{18 Maurer, H. R. 2001}}.

CD44 is known to be produced by cancer cells that effect tumour growth and metastasis as well as the regulation of lymphocyte aggregation in inflammation {{25 Chobotova, Katya 2010}} and it is known that the amount of CD44 in the circulatory system correlated to the diagnosis and prognosis of the cancer {{25 Chobotova, Katya 2010}}. In research the effects of bromelain on certain types of cancers has been shown to reduce the production of CD44 Harrach et al in {{18 Maurer, H. R. 2001}}.

In conclusion it is suggested by the scientists undertaking research in bromelain that a lot more must be done before the anti-cancer therapeutic value of bromelain can be conclusively evidenced to be anti-metastatic, tumour reducing and to show the effects on the haemostatic system and inflammatory regulators and markers but research to date has shown favourable evidence both anecdotal and laboratory based. Combined with the antioxidant qualities of the phenolic content found in pineapple it may well prove to be a fruit we will be using more and more in the fight against cancer, heart disease and other dysfunctions.