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Pineapple *(Ananas comosus)* Has Its Promising Future in the Treatment of Anxiety

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ABSTRACT

Anxiety disorder is very common in the world. It increases very rapidly because of today's stressful lifestyle. Patients suffering from anxiety exhibit different symptoms like panic attacks, social phobias and obsessive-compulsive disorders. Many anti-anxiety drugs are available in market (buspirone, diazepam, etc.) but these drugs have numerous side effects like dependence, depression and amnesia. Herbal drugs like ashwagandha, kava, St. John's wart, etc. are quite safe as compared to allopathic drugs. Pineapple fruit is very popular in India. Pineapple mainly contains citric acid, ascorbic acid and bromelain components. These constituents show antioxidant property. Ascorbic acid and bromelain also exhibit anti – anxiety effect. They decrease oxidative stress and inhibit the glutamate NMDA binding which helps to control anxiety. Pineapple fruit also helps in relieving the symptoms of depression. Thus, pineapple can be used in the pharmacological and non – pharmacological management of anxiety.

1. INTODUCTION:

In today's world, anxiety disorder is very common. It increases rapidly due to stressful lifestyles. Anxiety is neurological disorder which causes panic attacks, social phobias and obsessive compulsive disorders (1,2). Anxiety to some extent is present in our normal life but treatment is needed when it is disproportionate to the situation and excessive (3). Anxiety disorder can happen to anybody from poor to rich person or from celebrity to common man. Many anxiolytics are available in the market but they produce numerous side effects (4). Some anxiolytics like diazepam, lorazepam, oxazepam, etc. causes withdrawal symptoms such as restlessness, agitation, amnesic effect, sleep problems, tremors and synergistic depressive effect with alcohol and other CNS (Central Nervous System) depressants. Buspirone causes side effects like dependence, central depression and amnesia. Barbiturates such as valproate, vigabatrin, pregabalin and gabapentin are also used in the treatment of anxiety. They causes hangover like effect and psychological dependency. Therefore, people are shifting to herbal drugs. Anxiolytic effect of herbal formulations is quite comparable with allopathic anxiolytic drugs. Herbal drugs are quite safe and can be used in the prevention and treatment of anxiety (5,6).

2. PINEAPPLE *(Ananas comosus)*:

Fruits and vegetables play a vital role in our diet. One of the very popular fruit is pineapple. It is generally consumed as a juice and salad. Pineapple is *Ananas comosus* (L.) Merr. belong to the family Bromeliaceae. It is herbaceous, tropical and monocot perennial plant. It is 2-3 cm tall and wide. Shape and structure of pineapple is very unique which consist of broad leaves and fruits. Leaves of pineapple are spiral in arrangement and their terminal ends contains flower which grown into edible fruit. After bananas and citrus fruits, pineapple is the most produced fruit in the world. It is also known as ananas in India and is very popular due to its taste. It is used as a flavoring agent in pharmaceutical industry. India is the one of the important producer of pineapple. In India, Assam, Tripura, Manipur and Meghalaya are the main producers of pineapple. It is also produced in other countries like Thailand, China, Philippines, Nigeria, Indonesia and Brazil (7).

3. NUTRITIONAL VALUE:

Pineapple is very rich in nutrients. It mainly contains 80-81% water and 13 to 19 % total solids. The total solids contains 85% carbohydrates especially sucrose, glucose, and fructose

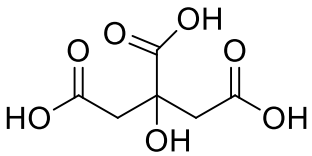
and remaining 15% contains essential nutrients. Essential nutrients contain vitamin C, B6, B1, A, iron, magnesium, niacin, calcium, potassium, phosphorus and zinc, fibers, folate, pentothenic acid, glycans etc. These components make pineapple a good food for part of a balanced nutritional diet. Most important thing about pineapple is that it contains low amount of fat and sodium, but contains large amount of carbohydrate.

4. CHEMICAL COMPOSITION:

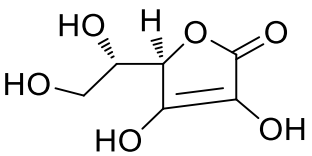
Pineapple generally consists of water, sugars, carbohydrates and vitamins especially A, B and C. It also contains proteins, fat, ash and fibers. Apart from these it consists of antioxidants especially flavanoids and many phenolic compounds like citric acid and ascorbic acid (8). It also contains minerals such as calcium, phosphorus and iron (9). Pineapple leaves contain caffeic acid, 1-O-Caffeoylglycerol, p-coumaric acid, 1-O-p-coumaroylglycerol, ananasate (10).

Pineapple also contains bromelain compound. It also has many medicinal values. It is one of the main components of pineapple. It is present in stem, fruit and peels of pineapple (11). Bromelain is a mixture of proteolytic enzyme. It consists of sulphahydryl proteolytic fraction, peroxidase, acid phosphatase, many protease inhibitors and bound with calcium. Therefore, it is used as an anti-inflammatory, anti-coagulant, anti-thrombolytic agent. Apart from these it also exhibits strong immunogenicity property and helps in many skin disorders (12).

Pineapple also contains some volatile constituents which help to maintain its aroma. Some of volatile constituents present in pineapple are methyl 2-methylbutanoate, 2- ethyl 2-methylbutanoate, ethyl acetate ,5-dimethyl-4-hydroxy-3(2H)-furanone, ethyl butanoate, ethyl 2-methylpropanoate, methyl hexanoate, ethyl hexanoate, and methyl butanoate (13). The chemical structures of pineapple are shown in figure no. 1.



Citric Acid



Ascorbic Acid

Figure 1: Chemical Structures of Pineapple

5. MEDICINAL VALUE:

Pineapple is used in foods, salads and pickles. Traditionally, it has been used for medicinal purposes in many cultures. Pineapple was used to induce abortion and in pregnant women, it was used to induce labors. It was used as anti-microbial, vermicide, purgative, etc. (14, 15). As time has passed, its popularity increases due to its nutritional values and beneficial ingredients. Pineapple has many medicinal values. Every part of the pineapple plant has its own value including its residue and waste. Medicinal values of pineapple are shown in table number 1.

Table 1: **Medicinal values of pineapple**

S.no.	Plant part	Uses	Reference
1.	Aqueous extract of crown leaf	Antimicrobial	15
2.	Stem pineapple	Antitumor activity	16
3.	Fruit	Antioxidant activity	17
4.	Leaf	Antifungal activity	18
5.	Waste	Anti amylolytic	19
6.	Peel extract	Antibacterial activity	20
7.	Fruit	Retards urinary tract infection during pregnancy	21
8.	Fruit	Prevent diabetes	22
9.	Methanol peel extract	Hypolipidemic activity	23
10.	Aqueous extract of fruit pulp	Angiotensin Converting Enzyme Inhibitory Activity	24
11.	Juice	Antiproliferative activity on Ovarian and colon cell lines	25
12.	Juice	Decrease inflammation	26
13.	Fruit	Antidepressant activity	27
14.	Methanol extract of peel	Antidepressant activity	28

6. PROMISING FUTURE IN THE TREATMENT OF ANXIETY:

Pineapple can be used to prevent and treat many diseases. It has been proved that one pineapple a day can prevent depression (24). One of very common disease now a days is anxiety.

Anxiety can occur due to overproduction of pro-inflammatory cytokines and oxidative biomarkers (29,30). It occurs due to imbalance between pro-oxidant and anti-oxidant levels, increased levels of reactive oxygen species, lipid peroxidation and decreased levels of anti - oxidant defenses (31,32). Oxidative stress can be increased mainly due to traumatic brain injury or may be due to autoimmune diseases (33,34,35). Oxidative stress is a serious imbalance between pro-oxidant and antioxidant levels; and increased levels of intracellular reactive oxygen species i.e. superoxide radicals, hydroxyl radicals and hydrogen peroxide which damages tissues (21). Cigarette smoke, alcohol, dietary iron, etc. affects the pro-oxidant and anti-oxidant levels (37, 38, and 39).

Now a days, people are trying to manage their specific health problems through altered diet (40). Plants have different types of phytoconstituents and enzymes which have antioxidant property. Many diseases can be prevented by antioxidants. Bajpai et al. reported that people who include sufficient quantity of plants and fruits in their diet have less chances of degenerative diseases (41). Fruits also contain flavanoids which are very potent antioxidants. Some scientists proved that flavanoids can protect lipid membrane from oxidation (42, 43). Pineapple fruit also have flavanoids and phenols. Total flavanoid content of pineapple methanol fruit extract is approximately 55.2 mg quercetin/g (44). It also contains phenols such as citric acid and ascorbic acid. Citric acid also has antioxidant property (45). It reduces the oxidative stress and decreases the free radical species.

Further, ascorbic acid is also very helpful in the anxiety. It is reported that ascorbic acid reduces the oxidative species and inhibits the glutamate NMDA binding which helps to control anxiety like behaviour (46). In the case of anxiety, glutamate neurotransmitter plays a very important role. Increased glutamate signaling in brain increases an anxiety like behavior (47). Glutamate mainly influences the N-methyl-D-asparate (NMDA) receptors (48). NMDA causes the production of nitric acid which further causes the anxiety like behavior (49,50).

Bromelain is one of the important constituents in pineapple. It is basically a protolytic enzyme (12). It is a mixture of various phosphatases, peroxidases, thiol endopeptidases,

glucosidase, cellulases, carbohydrates, glycoproteins and many protease inhibitors (51). Bromelian has antioxidant property by inhibiting lipid perioxidation and reduces free radicals (52). Generally, bromelain is extracted from stems and fruits. But bromelain extracted from fruits showed higher proteolytic activity (53). It was proved that bromelain had anti - anxiety effect in animals (54).

7. CONCLUSION:

Anxiety is neurological disorder affecting many people in the world. So, prevention and treatment of anxiety is very important. Herbal products and drugs are very safe in the prevention and long term treatment of anxiety. Pineapple is very common and popular fruit in India**.** It is used in the prevention and treatment of many diseases like hypertension, diabetes and many more. It can be used in a pharmacological and non – pharmacological management of anxiety. Pineapple decreases the oxidative stress and inhibits the glutamate NMDA binding which control the anxiety behavior. Pineapple fruit can be added in the diet plan of person suffering from anxiety.

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