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Nutritional Value and Medicinal Benefits of Pineapple

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Abstract: This paper discusses nutritional values and importance of pineapple in the health aspects. Thailand, Philippines, Mexico, Costa Rica, Brazil, China, Nigeria, Kenya, Indonesia, Hawaii, India, Bangladesh are the major pineapple producing countries. The demand of pineapple in the international market is expanding day by day. Generally, the ripen pineapple fruit is consumed fresh and juice as source of essential minerals and vitamins with some medicinal values. Pineapple contains considerable calcium, potassium, fibre and vitamin C. Various food items like jam, jelly, pickles are produced from pineapple. Qualities of pineapple vary due to growing environment and variety. Ripening agents accelerates ripening, but affects the nutritional quality of the pineapple fruits.

Keywords: Pineapple, Food Value, Medicinal Use, Importance

1. Introduction

Pineapple [*Ananas comosus* (L.) Merr. Family: Bromeliaceae] is one of the most important commercial fruit crops in the world. It is known as the queen of fruits due to its excellent flavour and taste [1]. Pineapple is the third most important tropical fruit in the world after Banana and Citrus [2]. Pineapples are consumed or served fresh, cooked, juiced and can be preserved. This fruit is highly perishable and seasonal. Mature fruit contains 14% of sugar; a protein digesting enzyme, bromelin, and good amount of citric acid, malic acid, vitamin A and B [3]. Pineapple juice's composition varies depending on geography, season, process and time of harvest. Its balance of sugar and acid contributes to the fruit's refreshing flavour [4]. Thailand, Philippines, Brazil and China are the main pineapple producers in the world supplying nearly 50 % of the total output [5]. Other important producers include India, Nigeria, Kenya, Indonesia, Mexico, Costa Rica and these countries provide most of the remaining fruit [6]. Green pineapple is also used for making pickles. After extraction of its juice, the left over is used as livestock feed and also the tender leaves are used for the same purpose. Various food items like squash, syrup, jelly are produced from pineapple. Vinegar, alcohol, citric acid, calcium citrate etc. are also produced from pineapple. Pineapple is also recommended as medical diet for certain diseased persons [7]. The U.S. National Library of Medicine lists bromelain as a proteolytic digestive enzyme. When taken with meals, bromelain aids in the digestion of proteins, working to break proteins down into amino acids [8].The paper is an overview of different aspects of nutritional value and medicinal uses of pineapple in different areas of the world.

2. Nutritional Value

Pineapple is a wonderful tropical fruit having exceptional juiciness, vibrant tropical flavor and immense health benefits. Pineapple contains considerable amount of calcium, potassium, vitamin C, carbohydrates, crude fibre, water and different minerals that is good for the digestive system and helps in maintaining ideal weight and balanced nutrition. Pineapple is a common fruit in Bangladesh and it has minimal fat and sodium [9]. It contains 10-25 mg of vitamin [10].Pineapple composition has been investigated mainly in the edible portion. Pineapple contains 81.2 to 86.2% moisture, and 13-19% total solids, of which sucrose, glucose and fructose are the main components. Carbohydrates represent up to 85% of total solids whereas fibre makes up for 2-3%. Of the organic acids, citric acid is the most abundant in it. The pulp has very low ash content, nitrogenous compounds and lipids (0.1%). From 25-30% of nitrogenous compounds

are true proteins. Out of this proportion, Ca. 80% has proteolytic activity due to a protease known as Bromelin. Fresh pineapple contains minerals as Calcium, Chlorine, Potassium, Phosphorus and Sodium [11].

Table 1. *Nutrients in 100 grams (g) pineapple [3].*

Nutrients	Amount
Energy	52 calories
Dietary fibre	1.40g
Carbohydrate	13.7 g
protein	0.54 g
Iron	0.28 mg
Magnesium	12 mg
Calcium	16 mg
Potassium	150 mg
Phosphorus	11 mg
Zinc	0.10 mg
Vitamin A	130 I.U
Vitamin B 1	0.079 mg
Vitamin B 2	0.031 mg
Vitamin B 3	0.489 mg
Vitamin B 6	0.110 mg
Vitamin C	24 mg

Pineapple juice contains ascorbic acid and is a good source of Vitamin C. Ascorbic acid or vitamin C fights bacterial and viral infections which is an effective antioxidant and helps the body absorb iron. Half a cup of pineapple juice provides 50 percent of an adult's daily recommended amount of vitamin C [4]. Several essential minerals exist in pineapples, including manganese, a trace mineral instrumental to the formation of bone, as well as the creation and activation of certain enzymes. Pineapples also include copper, another trace mineral. It assists in the absorption of iron and regulates blood pressure and heart rate [8].

Table 2. *Physical and chemical constituents of pineapple pulp and waste [14]*

Parameters	Pineapple pulp	Pineapple waste
Moisture (%)	87.3	91.35
Ash content (mg/100g)	1.8	0.04
Total soluble solids (%)	13.3	10.2
Crude fibre (g/100g-fw)	0.41	0.60
Total sugars (%)	8.66	9.75
Reducing sugars (%)	10.5	8.2
Non-reducing sugars (%)	7.4	8.8
Titratable acidity (%)	2.03	1.86
Ascorbic acid (mg/100g)	21.5	26.5

The Honey Queen Variety is superior in nutritional content as well as sweetness than the Giant Kew variety of pineapple. The Giant Kew variety contained 6% Total soluble solids (TSS), 3.88% total sugar and 1.75% non reducing sugar. On the contrary, the Honey Queen variety contains 10% TSS, 4.84% total sugar and 1.59% non reducing sugar. Honey Queen contains all the minerals in higher amount than the Giant Kew variety but Giant Kew contains higher Vitamin C than Honey Queen. The Honey Queen contains higher amount of calcium than the Giant Kew [12]. Ascorbic acid value of pineapple in Nigeria is 22.5 -33.5 mg/100g-fw [13]. The reducing sugar was higher in pineapple pulp when compared with pineapple waste. The maximum amount of reducing sugar (10.5 %) is observed in pineapple pulp. The total sugar content of Indian variety was higher in waste (9.75%) than in pulp (8.66%).The total sugar content of pearl pineapple of Brazil had a total sugar content of 14.5%. TSS varies from 10% to 14% brix depending upon the stage of maturity and season [14]. The reducing sugar content of pineapple was lower in Indian Varieties (10-12.5) [13]. But Ghana pineapples contain higher amount of reducing sugar (16.5%) [15].The TSS value of Indian pineapple was higher in pulp (13.3%) than waste (10.2%). TSS Value of Malaysian Josapine pineapple was 13.5% [16]. Ascorbic acid content slightly decreased in ripening stage of pineapple fruits [17]. The pineapple waste had high moisture content (91.35%) and moderate titratable acidity [14]. Moisture content of pineapple range from 69 to 89.5%.But it decreased during room temperature storage and ripening period [18].

3. Uses as Food

Pineapple fruits exhibit high moisture, high sugars, soluble solid content ascorbic acid and low crude fibre. Thus pineapple can be used as supplementary nutritional fruit for good personal health [14].The pineapple fruits are normally consumed fresh or as fresh pineapple juice. Field ripe fruits are best for eating fresh, and it is only necessary to remove the crown, rind, eyes and core. Pineapple may be consumed fresh, canned, juiced, and are found in a wide array of food stuffs - dessert, fruit salad, jam, yogurt, ice cream, candy, and as a complement to meat dishes [8]. In Panama, very small pineapples are cut from the plant with a few inches of stem to serve as a handle. The flesh of larger fruits is cut up in various ways and eaten fresh, as dessert, in salads, compotes and otherwise, or cooked in pies, cakes, puddings, or as a garnish on ham, or made into sauces or preserves. Malayans utilize the pineapple in curries and various meat dishes. In the Philippines, the fermented pulp is made into a popular sweetmeat. The pineapple does not lend itself well to freezing, as it tends to develop off flavours. Canned pineapple is consumed throughout the world. In Africa, young, tender shoots are eaten in salads. The terminal bud or "cabbage" and the inflorescences are eaten raw or cooked. Young shoots, called *"hijos de pina"* are sold on vegetable markets in Guatemala [3].

4. Medicinal Value

Pineapple can be used as supplementary nutritional fruit for good personal health. Pineapple fruits are an excellent source of vitamins and minerals. One healthy ripe pineapple fruit can supply about 16.2% of daily requirement for vitamin C [14]. Vitamin C is the body's primary water soluble antioxidant, against free radicals that attack and damage normal cells. A powerful antioxidant, vitamin C supports the formation of collagen in bones, blood vessels, cartilage and muscle, as well as the absorption of iron. Vitamin C also retards the development of urinary tract infections during pregnancy and reduces the risk of certain cancers, including

colon, esophagus and stomach [8]. Malic acid makes up 13 percent of pineapple juice's acidic content. Malic acid is also beneficial for health. It boosts immunity; promotes smooth, firm skin; helps maintain oral health; and reduces the risk of toxic metal poisoning [4]. Pineapple is also a good source of vitamin B_1, vitamin B_6, copper and dietary fibre. Pineapple is a digestive aid and a natural anti-inflammatory fruit. Fresh pineapples are rich in bromelain used for tenderizing meat. Pineapple contains a proteolytic enzyme bromelain, which digests food by breaking down protein. Only modest quantities of bromelain are in the edible parts of the fruit, all commercially available bromelain is derived from the stem. Bromelain supplements are particularly popular among athletes for treating all sorts of physical aches and injuries. Drinking pineapple juice can help hydrate the body and restore the immune system. It helps to build healthy bones. Pineapples are rich in manganese, a trace mineral that is needed for body to build bone and connective tissues. One cup of pineapple provides 73% of the daily recommended amount of manganese. The benefits of pineapple can affect the growth of bones in young people and the strengthening of bones in older people. Pineapple juice's high manganese content means it is a good choice for boosting fertility through sperm quality [8]. Bromelain has demonstrated significant anti-inflammatory effects, reducing swelling in inflammatory conditions such as acute sinusitis, sore throat, arthritis and gout and speeding recovery from injuries and surgery. Pineapple enzymes have been used with success to treat rheumatoid arthritis and to speed tissue repair as a result of injuries, diabetic ulcers and general surgery. Pineapple reduces blood clotting and helps remove plaque from arterial walls. Pineapple enzymes may improve circulation in those with narrowed arteries, such as angina sufferers. Pineapples are used to help cure bronquitis and throat infections. Pineapple is an excellent cerebral toner; it combats loss of memory, sadness and melancholy. For any kind of morning sickness, motion sickness or nausea, drinking pineapple juice is advised. It works effectively in getting rid of nausea and vomiting sensation. Pineapple is known to be very effective in curing constipation and irregular bowel movement. This is because it is rich in fibre, which makes bowel movements regular and easy. Pineapple is effective in getting rid of intestinal worms and also keeps the intestines and kidneys clean. It helps prevent gum disease and also prevents the formation of plaque, thus keeping the teeth healthy. The flesh of very young (toxic) fruits is deliberately ingested to achieve and as a drastic treatment for venereal diseases. In Africa the dried, powdered root is a remedy for edema. The crushed rind is applied on fractures and the rind decoction with rosemary is applied on hemorrhoids. Indians in Panama use the leaf juice as a purgative, emmenagogue and vermifuge [3]. Pineapples pulp had average crude fibre content of 0.45±0.03g/100g [14]. Fibre content of Indian pineapple had 0.5g/100g-fw in fruit [19]. Fibre helps to maintain the health of gastrointestinal tract, but in excess it may bind some trace elements [20]. The whole plant is used to treat typhoid fever in Ijebu Ode Local Government Area in Ogun State of Nigeria [21]. Roasted unripe fruit juice is used by different communities of Gohpur of Sonitpur district, Assam, India for strangury [22]. Pineapple creates low blood pressure, cure inflammation disease, used for weight loss, control the death rate and prevent diabetes & radical damage. It cures the damaged teeth and makes them strong and healthy. Also help to cure sinusitis and throat problem. Cure different diseases like asthma, obesity, swollen in the body, problems of digestion and heart problem. Pineapples are rich of manganese which creates strong bones and muscular body. Atherosclerosis and immune disease can be also cured due to high antioxidant. It does not let damage the cells of body, it is so hot so it is used to ignore cold weather, also used for perfect powerful unbreakable body, prevent cancer, heart attack, nausea and gives the long natural hairs. Use to solve acne, wrinkles, age problem and create strong nails, soft lips and thick hair [23]. The *Garo* tribal community of Netrakona district in Bangladesh uses fruit juice for fever and leaf juice for helminthiasis and jaundice [24]. *Ananas comosus* leaves have antihyperglycemic and analgesic properties. That can be use as a cheaper and alternative source of medicine for reducing high blood sugar level of diabetic patients [25]. The root and fruit are either eaten or applied topically as an anti-inflammatory and as a proteolytic agent. It is traditionally used as an anthelmintic agent in Tripura, India. A root decoction is used to treat diarrhea. It is advised to take advantage of pineapple's myriad healing powers, by drinking 3 ½ ounces of fresh pineapple juice three times daily before meals or by eating a slice of fresh pineapple at each meal [8]. Phytochemical screening showed presence of alkaloids, flavonoids, saponins and tannins in the pineapple leave extract, which components can be responsible for the observed blood glucose lowering and analgesic effects [25]. One of the best known properties of pineapple is as a diuretic. This helps to eliminate toxins through the urine, helping patients with ailments of kidneys, bladder and prostate. Due to the fiber content of the pulp, pineapple prevents constipation and regularizes the intestinal flora. Furthermore, there is evidence of appetite reducer, heart protection and aid for fever, sore throat and mouth aches and inflammation. Lightly boiled ground pineapple can be used to clean infected wounds because it eliminates dead tissues, not affecting live tissue, acts as disinfectant [26] Pineapple is a rich source of vitamin C as well as other vitamins and fibre. Pineapple's bromelin stimulates digestion and the proper performance of the small intestine and kidneys; it helps in detoxification, normalizes colonic flora, helps in hemorrhoid alleviation, and prevents and corrects constipation. It has been used to heal colds, mouth, throat and bronchial infections. Cooked peel cleans blood and alleviates swellings. Juice helps to cure cystitis, and fevers [27].

5. Environment and Health Hazard

Pineapple production in large scale by high-input is dependent on regular and intense use of number of toxic agrochemicals. Across the country the poor environmental

practices of many national and international producers is leading to environmental problems such as contamination of ground water, soil erosion, sedimentation and deforestation [28]. Recently in Bangladesh, people are consuming fruits, ripened with hazardous chemicals like calcium carbide. This poses great health risks consumers [29]. Consumers prefer large, bright pineapples but naturally grown fruit is not as large or brightly colored as its chemically-treated competitor Farmers growing pineapples without chemical and hormone additives are facing mounting losses because demand for their product is proving to be weak. Many farmers spray growth boosting chemicals and hormones on pineapple flowers to produce large fruit and then apply hormones to immature fruit to early harvesting [30].The use of artificial agents may give more acceptable color than naturally ripened fruits [31], but it may increase the risk of contamination of food materials. The use of toxic ripening agents is common in developing countries. Artificial ripening accelerates ripening, but affects the nutritional quality of the fruits [32]. The eating big amount of Pineapples has much sugar which can create diabetes, and dried have much sugar rate then fresh, so use small amount of dried fruits. It can also affect on skin and lips due to much eating [19]. When unripe, the pineapple not only inedible but poisonous, irritating the throat and acting as a purgative. Excessive consumption of pineapple cores has caused the formation of fibre balls in the digestive tract [3]. Consuming large quantities of fresh pineapple juice can cause mouth and esophagus soreness. The irritation results from the combined action of the acids, bromelain enzymes and calcium oxalate crystals. The high level of citric acid in fresh, unsweetened pineapple juice may cause an upset stomach if large quantities are consumed, especially on an empty stomach [4]. The fruit acids in pineapple can have an aggressive, corrosive effect on certain substances. In the body, the gums and tooth enamel are at particular risk and eating too much pineapple may contribute to gingivitis and cavities [8].

6. Conclusion

The world pineapple demand has been expanding rapidly. Pineapple is a common fruit in Bangladesh as well as in some other countries of the world and it contains good amount of various vitamins, carbohydrates, crude fibre, water and different minerals that is good for health. Pineapple contains considerable amount of calcium, potassium, fiber, and vitamin C etc. Generally, the ripen pineapple fruit is consumed fresh and juice as source of many essential minerals and vitamins. Fresh pineapples are rich in bromelain that used as anti-inflammatory, reducing swelling in inflammatory conditions such as acute sinusitis, sore throat, arthritis, gout. Various food items like jam, jelly, pickles are produced from pineapple. The Honey Queen Variety is superior in nutritional content as well as sweetness than the Giant Kew variety of pineapple in Bangladesh. Farmers spray growth boosting chemicals and hormones on pineapple flowers to produce large fruit and apply hormones to early harvesting but it may increase the risk of contamination of food materials. In some cases, unripe pineapple is inedible, poisonous and irritating the throat and acting as a purgative. Excessive consumption of ripen pineapple cores formation of fibre balls in the digestive tract. It has huge nutritive value but it has also few side effects.

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