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Delving Into the Analytical and Therapeutic Features of Annona Squamosa: an In-Depth Study

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Abstract: *Known by most as the "custard apple," Annona squamosa has a number of medicinal uses. It is highly advised to use Annona squamosa to eliminate toxins from the human body. Additionally, it is used to treat respiratory tract conditions such allergies, asthma, colds that come on season, and antitussive medications. Studies on Annona squamosa have also shown the plant's anti-inflammatory, anti-asthematic, anti-microbial, analgesic, anti-diarrheal, and immunomodulatory qualities. The greatest illustration of it is Annona squamosa, which is a member of the Annonaceae family. This tree has several uses and tasty fruits. Its edible fruits are referred to as custard apples. Ice cream may be flavored with the pulp. Of the fruit, 50–80% are edible. Considerably more vitamin C (35–42 mg/100 g) is present than in grapefruit. Thiamine, potassium, and dietary fiber have important nutritional values as well. Numerous chemical substances have been found to be present in it, including alkaloids, isomeric hydroxyl ketones from the leaf, squamone from the bark, acetogenin, samaquasine, annonacin, and annonastatin from the seeds. Its antibacterial, antidiabetic, anticancer, anti-malarial, anthelmintic, anti-genotoxic, and hepatoprotective properties have been shown in a number of investigations. The leaves are used to abscesses, bug bites, and other skin conditions in addition to being used as a vermicide and to cure malignant tumors. Crushed leaves were applied to wounds and sores as well as inhaled to combat hysteria and fainting episodes.*

Keywords: Therapeutic properties, Medicinal potential.

I. INTRODUCTION

Herbal and plant-based remedies have been used historically to treat illnesses. The Indian medical system is ingrained in our culture and serves a sizable portion of our populace. The common people's health has not yet improved to the full potential of other alternative medications, despite their appeal and uplifting applications. The active ingredients in herbal remedies are more advantageous for human and animal usage than the vitamins and minerals they include. One of them that is often used in the Ayurvedic medical system is Annona reticulate (Mariam et al., 2018). The Annona family includes the delectable and subtly aromatic custard apple. The fruit's creamy-textured, sweet flesh with a hint of tanginess. In English-speaking nations, bullock's heart is another name for it. Custard is referred to as a "multiple-fruit" in botany, meaning that it develops from the union of several separate blossoms (ovaries) into a sizable fruit mass (in fructescence). The custard apple is a fruit with polygonal indentations on its surface that is globular, round to heart-shaped. There are several varieties, and depending on the variety, the fruits might be maroon, yellow, brown, or green (Pandey et al, 2013).

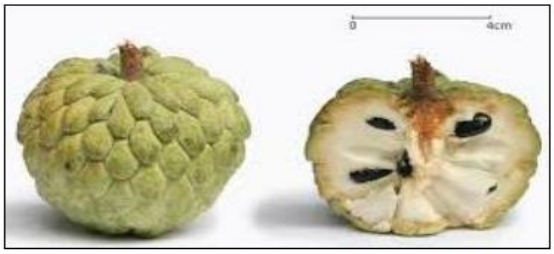

Fig 2: Tree of Annona squamosa

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Among the notable members of this genus, the custard apple, Annona reticulata L., is often regarded as the mediocre or "ugly duckling" species, both in tree and in fruit. Its English descriptive name has been widely misinterpreted to refer to other species as well as the hybrid ATEMOYA. It is also occasionally incorrectly called "sweetsop," "sugar apple," "anon" or "rinon" by Spanish-speaking individuals, and "ramphal" in India, all of which are correctly applied exclusively to Annona squamosa. Only a few number of suitable regional names have been given to it (Pandey et al., 2013).

The names chirimoya roia in Bolivia, anona rosada in El Salvador, and anona roja or anona colorada in Guatemala all allude to skin color. It is also referred to as anona de seso in the latter nation. In Brazil, araticum ape or araticum do mato are other names for it. Custard apple boasts a strong exterior peel, according to some. Inside, each aril is made up of a single, glossy, deep brown seed enclosed in a cream-colored sheath. Its flesh has a grainy texture just under the surface. Ignore the skin and seeds since they are inedible. Its taste, which has been compared to mangosteen, melts in the tongue and is sweet and subtly tart. Growing widely in the Philippines, custard apples are smaller than cherimoya (A. cherimola), Pond apple (A. glabra), and soursop (A. muricata), but somewhat bigger than sugar apples (Atis fruit) (A. squamosa). Custard apple and sugar apple are often used interchangeably (Morton et al., 1987).

Traditional Uses

Because of the cyclic peptides present, it has been traditionally used as an insecticidal, anticancer, anti-diabetic, antioxidant, anti-lipidemic, and anti-inflammatory drug. A remedy for heart failure and palpitations may be made by infusing two handfuls of fresh leaves in one lit of water (1 cup after meal). This infusion has antispasmodic properties and is also beneficial for healthy digestion. It is said that the seeds contain anti-parasitic properties (against lice). Before applying the cream to the hair, a mixture of 3 cups bee wax, 12 cups almond oil, 3 cups coconut oil, 6 cups water, 6 cups glycerin, and a handful of crushed plant seeds is produced and heated over a water bath for three hours. In India, a leaf decoction is consumed in instances of diarrhea and crushed leaves are applied to wounds and sores. For the treatment of diabetes, people in the Aligarh area in Northern India used to eat a combination of four to five freshly produced young Annona squamosa leaves and black pepper (Piper nigrum). Research has shown that doing so might guarantee up to 80% of the benefits of ongoing treatment. The infusion of bark is used as a tonic and to prevent diarrhea. A leaf infusion is used across tropical America as an emmenagogue, febrifuge, tonic, cold cure, digestive, or to make urine clearer. In order to relieve rheumatic discomfort, the leaf decoction is frequently used in baths (Streit, 2019).

An Ayurvedic remedy for cough, cold, and sneezing nose is Sitopaladi Churna. The administration of the leaf aqueous extract also decreased blood glucose and lipid peroxidation levels and enhanced plasma insulin and lipid profile activities, suggesting that the extract can also significantly lower high levels of total cholesterol and triglycerides associated with diabetes. Certain species' bark, leaves, and roots are used in traditional remedies. In the Amazon Rainforest, the robust bark is utilized for making wooden tools like tool handles and pegs, as well as for hauling loads. The wood is prized for its fireside colors, which are yellow and brown (Olaban et al, 2014).

Table 1: Nutrive value of Annona reticulata

Custard apple (Annona reticulata), Fresh, Nutritive value per 100 g, (Source: USDA National Nutrient data base)		
Principle	Nutrient Value	Percentage of RDA
Energy	101 Kcal	5.0%
Carbohydrates	25.20 g	19.0%
Protein	1.70 g	3.0%
Total Fat	0.60 g	3.0%
Cholesterol	0 mg	0.0%
Dietary Fiber	2.4 g	6.0%
Vitamins		
Niacin	0.500 mg	3.5%
Pantothenic acid	0.135 mg	2.5%
Pyridoxine	0.221 mg	17.0%

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Riboflavin	0.100 mg	8.0%
Thiamin	0.80 mg	7.0%
Vitamin A	33 IU	1.0%
Vitamin C	19.2 mg	32.0%
Electrolytes		
Sodium	3 mg	<1.0%
Potassium	382 mg	8.0%
Minerals		
Calcium	30 mg	3.0%
Iron	0.71 mg	9.0%
Magnesium	18 mg	4.5%
Manganese	0.093 mg	4.0%
Phosphorus	21 mg	3.0%

Fig 3: annona squamosa linn. plant: (a) leaves, stem, flowers and fruits; (b) matured fruit; (c) pulp; (d) seeds; (e) dried fruit powder; (f) canned pulp; (g) fruit shake; (h-i) sitaphal ice-cream; (j) sitaphalrabdi; (k) sitaphal kheer

The juice is used to treat fever and chills in Mexico. It was shown that pulp has mutagenic properties. It is grown beside banana plantations and is mostly utilized as a decorative plant. This fruit, with orange peel, is indigenous to Brazil and is hardly seen. Hysteria and fainting episodes are treated with leaves, and the juice is used as a vermifuge. Dried, unripe fruits that are used to cure dysentery and diarrhea. For toothaches, root and bark are utilized. Young fruits, seeds, and leaves all contain insecticidal properties. Folk medicine uses seeds because of their parasitic and insecticidal properties. Apomorphine alkaloids have been found in roots; reomerine, annonine, and dehydroreomerine having skeletal muscle relaxant properties. The yellow resin that is derived from seeds displays sympathetic actions, such as pupil dilation, mouth dryness, and secretion reduction. Studies conducted in vivo and in vitro have shown anti-tumor efficacy. Fruits and fruit juice are used as an astringent for diarrhea and dysentery, to treat worms and parasites, to lower fevers, to increase a mother's milk after delivery, and many more purposes. Crushed seeds are used to combat worms, head lice, and internal and external parasites. The bark, leaves, and roots are used to make a tea that is used to cure a variety of ailments due to its sedative, ulcer-healing, and nervine properties. The decoction of leaves is used to cure acidity, intestinal infections, colds, and coughs. For diarrhea, a decoction of bark is used, while for dysentery, roots are utilized. Ice creams and milk drinks are made using fruit. According to Zahidm et al. (2017), crushed leaves are used to treat boils, gastritis, and internal and exterior wounds.

Health benefits of custard apple

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- "Compared to cherimoya, custard apple has comparatively more calories." Compared to 56 calories in cherimoya, 100 g of this fruit has 101 calories. Simple carbs provide the majority of the calories. It does not, however, contain cholesterol or saturated fats.
- •Custards, like other fruits in the Annona family, are rich in polyphenolic antioxidants. The most well-known of these are called anonaceous acetogenins. Strong cytotoxins are acetogenin compounds like asimicin and annonacin. It has been discovered that these substances have anti-malarial, anti-cancer, and deworming effects.
- Custards have higher levels of vitamin C (19.2 mg/100 g) than cherimoya. Among all Annona fruits, sugar apples have the greatest concentration of this vitamin (36.3 mg/100 g). A potent natural antioxidant is vitamin C. The body develops resistance against infectious agents and eliminates damaging, pro-inflammatory free radicals from the body via the consumption of fruits rich in vitamin C. Custard apples are a moderate source of B-complex vitamins, particularly vitamin B-6 (pyridoxine, 17% per 100 g). Pyridoxine supports the brain's GABA neurotransmitter balance. Elevated blood levels of GABA are beneficial in reducing stress, headaches, and neurotic irritability.

Ayurvedic Pharmacology Properties

Antioxidant Activity: Using several antioxidant screening models, the leaves of Annona squamosa Linn. were examined for their capacity to scavenge free radicals. The highest amount of radical cation scavenging (up to 99.07%) of the ethanolic extract at 1000 µg/ml was observed in 2-azinobis-3-ethylbenzothiazoline-6-sulphonate) (ABTS). This was followed by the stable radicals (89.77%) and nitric oxide radicals (73.64%) at the same concentration. When rat brain homogenate was used, the extract's anti-lipid peroxidation potential and superoxide radical scavenging activity were only mild. The results support plants' antioxidant capacity (Shirnaikar and Rajendrank, 2004).

A research was conducted on streptozotocin (STZ)-induced diabetic rats to examine the antioxidant impact of oral administration of a plant's leaf aqueous extract on blood glucose, hemoglobin, glycosylated hemoglobin, plasma insulin, antioxidant enzymes, and lipid peroxidation in liver and kidney. Over the course of 30 days, oral administration of an aqueous extract to diabetic rats resulted in a significant reduction in blood glucose, lipid levels, and lipid peroxidation. However, the activities of antioxidant enzymes such as catalase, superoxide dismutase, reduced glutathione, and glutathione peroxidase, as well as plasma insulin, were enhanced.The study concludes that in experimental diabetic rats, aqueous extract administration is helpful in regulating blood glucose levels, improving plasma insulin and lipid metabolism, and reducing diabetes consequences from lipid peroxidation and antioxidant systems. Previous research findings shown that polar extracts outperformed less polar extracts in their ability to scavenge free radicals. High levels of flavonoids were found in the leaf extracts from both sections (Konda, 2019).

Anti-tumor Activity: All components of the plant Annona squamosa, often referred to as custard apple, are rich in bioactive compounds. On the rat histiocytic tumor cell line AK-5, the effects of aqueous and organic extracts from defatted plant seeds were investigated. Both extracts significantly increased caspase-3 activity and produced apoptoic tumor cell death. Reduced intracellular GSH levels were positively linked with the downregulation of the anti-apoptotic genes Bcl-2 and Bclxi as well as increased intracellular ROS production. Furthermore, annexin-V staining and DNA fragmentation verified that the extracts caused oxidative stress-induced death in tumor cells. Plant seed aqueous extract shown strong anticancer efficacy against AD-5 tumor in vivo. Previous research on plant seed extract has shown considerable anti-tumor effects against human hepatoma cells both in-vitro and in-vivo, suggesting that the extract may be developed into a new liver cancer medication. According to Magadula (2009), the seeds' aqueous extracts have strong anti-tumor efficacy against the AD-5 tumor in vivo.

Antimalarial Activity: Given the noteworthy activity shown by Annona squamosa extracts, it is likely that both plants have potent insecticidal properties, especially against mosquitoes. This makes them a potential source of larvicidal chemicals. At 50, the plant fractions with EtOAc were the most active, with 100 to 90% mortality. Further larvicidal testing of the three sub-fractions (Sq-1, Sq-2, and Sq-3) for plants revealed a dose-dependent ($p \geq 0.05$) but also dramatically reduced activity from its parent fraction at the same concentration levels, which helped identify the active principles in the EtOAc fraction. This suggests that a number of the extract's medium-polar molecules are working either cooperatively or competitively at the active sites. A plant that was gathered from Brazil showed larvicidal properties against Anopheles stephensi, C. quinquefascinits, and Aedes adopictus. The current larvicidal activity result validates the reports and shows that Annona species extracts have the ability to operate as anti-mosquito agents. All

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compounds shown modest effectiveness against both a chloroquine-sensitive and a chloroquine-resistant strain of Plasmodium falciparum in the recent tests on Annona squamosa (Suresh, 2008).

Anti-arthritic, Anti-inflammatory and Analgesic Activity: The combined extract of Annona squamosa and Nigella sativa was used to screen the aforementioned activities, and it was assessed and verified in a number of animal models. Complete Freund's Adjuvant (CFA) injections into the metatarsal footpad of Sprague-Dawley rats caused arthritis. The measurement of AST, ALT, and TP, together with the histology of the knee joint, were used to assess the degree of inflammation, along with hind paw edema and body weight. Paw volume significantly decreased, body weight increased, and high levels of ALT, AST, and TP were all significantly reduced as a consequence of the combination extract. The histological analysis disapproved of the plant extract-treated animal's considerable decrease in neutrophil infiltration, pannus production, and bone in terms of its anti-arthritic properties. When the extract was compared to equivalent reference standard medicines, indomethacin and pethidine sulfate, it was shown to have dose-dependent analgesic and anti-inflammatory action (Sochar, 2004).

Larvicidal Activity: Because they may spread dangerous illnesses, mosquitoes pose a severe threat to human health. The use of synthetic insecticides has led to the development of resistance and cross-resistance, as well as increased costs and potential toxicity dangers. These factors have sparked interest in the discovery of plant-based solutions in recent years. Annona squamosa has been shown to have larvicidal and growth-regulating properties against A. stephensi and other mosquitoes. According to Brown (1986), Annona squamosa was shown to have a high effectiveness as a larvicide against mosquito species. However, it is still necessary to identify the active ingredient that has a poisonous substance against the larval species.

During Pregnancy: Sitaphal aids in the development of a fetus's immune system, brain, and neurological system. Sitaphal taken regularly throughout pregnancy lowers the risk of miscarriage and lessens the intensity of labor pains during birth. Some people refer to it as the pregnant miracle fruit since it may assist with nausea, mood swings, and morning sickness. This fruit is very beneficial for the fetus's developing brain as well as for the strengthening of the immunological and neurological systems. It is a reliable copper supply. Pregnant women typically need 1000 µg of copper. Premature delivery may result from low body copper levels. Therefore, eating this fruit may be quite beneficial. It provides vitamins A and C, both of which are very beneficial to the developing baby. It works wonders for healthy blood vessel, skin, and eye development (Konda, 2019).

II. CONCLUSION

Numerous attributes have been attributed to the Annona squamosa Linn plant. The different activities have now been revalidated on a number of well thought out clinical novel models and studies. The plant's many forms have been shown to have antidiabetic, anti-inflammatory, antipyretic, antifertility, and anti-diarrhea properties. The herb is also harmless and has no negative side effects. The Annona squamosa linn offers the human body a variety of nutrients, including high protein, low cholesterol, and high fiber content. It is a helpful and healthful meal. Future research into this plant's pharmacological industries is warranted given its antioxidant activity and other qualities that seem to make it a great medicine for a variety of diseases. An inexpensive, dependable, and secure plant-based resource to satisfy the need for nutrient-dense food is Annona squamosa linn.

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