

## IMMINENT ATTRIBUTES OF SPLENDID STAR FRUIT (*AVERRHOA CARAMBOLA* L.)

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### ABSTRACT

Indisputably, fruits are very important in our daily diet for various health benefits. However, some fruits may contain high amounts of unique secondary metabolites, which are hazardous to our health. Star-fruit plants are cultivated commercially in tropical countries for their fruits. This fruit have several medicinal properties; hence, it is used medicinally for many years in Ayurvedic treatments. Star-fruits contain various antioxidants which are considered medicinally important and beneficial for the health. The Starfruit is sweet tasting fruit that possesses high nutritional value. From the time immemorial, the whole starfruit tree is used as a traditional medicine. The medicinal properties of Starfruit include anti-inflammatory, analgesic, hypotensive, anthelmintic, anti-oxidant, anti-ulcer, hypocholesterolemic and hypolipidemic, antimicrobial, anti-tumor activities. It is effectively used in diabetes and help to reduce the risk of heart disease and stroke. The endeavour of this review is to highlight the nutritional aspects, medicinal value, toxicological traits, phytochemical constituents, and pharmacological activities along with the current trends in research on starfruit.

**KEYWORDS:** Toxicity; TCM, CBX, Hypocholesterolemic, Hypolipidemic, Phytochemical constituents, Pharmacological activities.

### INTRODUCTION

Natural products and especially those derived from higher plants have historically played a pivotal role in the discovery of new pharmaceuticals. India has a rich heritage of traditional medicine and the traditional health care system has been flourishing in many countries. Population in developing countries depends mainly on the indigenous traditional medicine for their primary healthcare needs.<sup>[1-3]</sup> In recent years, the use of herbal medicines worldwide has provided an excellent opportunity to India to look for therapeutic lead compounds from an ancient system of therapy, i.e. Ayurveda, which can be utilized for development of new drug. Over 50% of all modern drugs are of natural product origin and they play an important role in drug development programs of the pharmaceutical industry.<sup>[4,7]</sup>



There are estimated to be around 25000 effective plant based formulations used in folk medicine and known to rural communities in India. It is estimated that there are over 7800 medicinal drug manufacturing units in India which consume about 2000 tones of herbs annually. At the present juncture, the modern conventional healthcare is burdened with great problems of unsafe medicines, chronic diseases, resistant infections, autoimmune disorders and degenerative disorders of ageing despite of great advances. Modern allopathic system has developed many sophisticated and costly diagnostic methodologies which at the times have made it quite exorbitant and beyond the reach of common man. Many modern synthetic drugs may harm more than they help in curing diseases by its serious effects.<sup>[8-10]</sup> On contrary, traditional medicines which make use of plants are much more esteemed being more safe without harmful effects and comparatively less expensive than many allopathic medicines. Undoubtedly, the plant kingdom still holds many species of plants containing substances of medicinal value which have yet to be discovered. From the centuries, herbal medicines have been used to treat various diseases and now they had become an item of global importance, with both medicinal and economic implications. Selecting the right scientific and systematic approach to biological evaluation of plant products, based on their use in traditional medicine is the key to ideal development of new drugs from plants. One such plant is Averrhoa carambola (Oxalidaceae), traditionally

known as 'kamrakh' and commonly known as star fruit because of its peculiar shape. It has widely been used in Ayurveda, preparations of its fruit and leaves are used to pacify impaired kapha, pitta, skin diseases, pruritis, worm infestations, diarrhea, vomiting, hemorrhoids, intermittent fever, over-perspiration and general debility.<sup>[11-14]</sup>

The Star-fruit producing plant (*Averrhoa carambola* L.) is a species of woody plant in the family Oxalidaceae native to the Philippines, Indonesia, Malaysia, Vietnam, India, Bangladesh and Sri Lanka; but, cultivated in many parts of the world. Star-fruits are popular tropical fruits and used commonly in Ayurvedic and Traditional Chinese Medicines (TCM) in India, China, and Brazil to relieve ailments such as chronic headache, fever, cough, gastro-enteritis, diarrhoea, ringworm infections, and skin inflammations. The word carambola comes from the Sanskrit word Karmaranga meaning "food appetizer"., this fruit contains high amount of oxalate, which is hazardous for uremic patients, and caramboxin (CBX), which is neurotoxic.<sup>[15-18]</sup> Whole star fruit plant is believed to be a traditional herbal medicine. Proper utilization of the antimicrobial, antioxidant, hypoglycemic, antidotal and many more beneficial properties of this therapeutic plant, especially its fruit will not only help to upgrade the medicine world, also will combat toxic effects of artificial drugs. However, the negative part of this fruit is that it produces oxalic acid and caramboxin, which are toxic to uremic patients.<sup>[19]</sup>

Tropical and sub tropically grown star fruit is generally being used as raw vegetable and ripe fruit. Though its perishable nature is a cause to think when it comes about storage, researchers are having successful results regarding storage and acceptability of the value added food products using star fruit.<sup>[20-22]</sup> Due to its perishable nature, star fruit did not get that much popularity in commercial aspect in spite of being an important traditional medicinal fruit and considered to be a usual one. But now a day, a lot of research studies are going upon this fruit and its other curative part viz., leaves, bark. It possesses a significant prospective not only for the use of medicinal purpose but also as the food processing items.<sup>[23-25]</sup>

### Culinary Uses

Carambola as ripe used as a source of food, eaten out-of-hand, sliced and served in salads, or used as garnish on avocado or seafood. Star-fruits are fleshly, crunchy, juicy and slightly tart, acidic and sweet in the taste. Star-fruits are commonly used in preparation of juice, pickles and salads. However, it can be eaten raw and used for cleaning utensils; because, it helps in removing the rust caused by iron oxidation.<sup>[26-29]</sup>

### Nutritional attributes of star-fruit

As evident from the literature, Star-fruit is a good source of Mg (magnesium), K (potassium), P (phosphorous), as well as  $\beta$ -carotene, and vitamin C, which are common

antioxidants. The presence of minerals viz. Fe (iron), Zn (zinc) and Mn (manganese) in the fruits aid in strengthening the immune system. In addition, the presence of high amounts of fibres in fruits aids in absorbing glucose and retarding the glucose diffusion into the blood stream; as a result, it helps in controlling blood glucose concentration. The Starfruit intake also exhibits hypo-cholesterolemic and hypolipidaemic effect as it enhances the removal of cholesterol, lipid, and bile acid through the excrement.<sup>[30-35]</sup>

**Minerals found in the star-fruits (*Averrhoa carambola* L.) On the dry basis minerals (K, Ca, P, Mg, Fe Cu, Zn, Mn) amount in mg/100g fruit is 167.13 – 168.0; 6.37 – 6.40; 17.87 – 17.88; 11.85 – 12.05; 0.34 – 0.45; 0.19 – 0.45; 0.29 – 0.51; 0.04 – 0.52 respectively**

The phytochemical and pharmacological studies suggest that the extracts of Star-fruit plant leaves, fruits and roots contains saponins, flavonoids, alkaloids and tannins which are known to confer antioxidant and specific healing properties. The major vitamins and acids found in star-fruits are mentioned here. On a dry weight basis amount of phytochemicals viz carotene, tartaric acid, oxalic acid, ketoglutaric acid, citric acid, vit B1 & B2, vit C in mature star fruit in mg /100g is 0.003 – 055; 4.37; 9.6; 2.2; 1.32; 25.8; 25.8 respectively.<sup>[36-38]</sup>

### Therapeutic benefits of Star Fruit Juice and Traditional Applications



Usually, when consuming Star-fruit juice, often the fibre's residual parts of fruits are excluded from the beverage. In spite of this, Star-fruit contains approximately 60% of cellulose, 27% of hemicelluloses and 13% of pectin. It indicates that star-fruit is indeed rich in insoluble fibres fractions (IFF).

The insoluble fibres have the ability to retain water more than cellulose; thus called as 'water insoluble fibre fractions' or WIFF. WIFFs actually aids in smooth movement of the bowels and has the capability of lowering blood glucose by slowing down the absorption of carbohydrate in our body<sup>39-40</sup>. In addition, the fibres also facilitate in lowering the total cholesterol level in the body by promoting hypoglycaemic effect. Consuming the fruit-juice together with the fibres (called as smoothie) does help in removing lipids through the excrement, and thus lowering the risks of cardiovascular diseases. It has also been reported that Star-fruit extracts do have selective anti-brain-tumour activity.<sup>[41-42]</sup>

In India, the ripe fruits or its juice are used as anti-pyretic, laxative, appetitestimulant, sialogogue, astringent and antiscorbutic. In Brazil, the fruit is recommended as diuretic in kidney and bladder related problems. In Chinese Materia Medica, it is used to quench thirst and to increase the secretion of saliva. In Ayurveda, the ripe fruit is considered as digestive, tonic and causes biliousness. Moreover, the fruits are also used to treat throat inflammation, mouth ulcer, toothache, cough, asthma, hiccups, food poisoning, colic, diarrhea, jaundice, malarial splenomegaly, hemorrhoids, skin rashes, pruritis, sunstroke and some eye related

problems. They are used as aphrodisiac for both men and women. In women, the fruits can be used to increase lactation and in large doses, they can act as an emmenagogue. The crushed leaves or shoots are externally applied in the treatment of chicken-pox, ringworm and headache. A decoction of boiled leaves is used to relieve aphthous stomatitis and angina. Moreover, the leaves are found to be useful in treating oliguria, boils and pyodermas, postpartum edema, gastroenteritis and traumatic injury. The boiled flowers are used as vermifuge, in fever and malaria. In Southeast Asia, the flowers are used in dermatitis.

The roots of *Averrhoa carambola* are used to treat arthralgia, chronic headache, epistaxis and spermatorrhea. The roots with sugar are considered as an antidote for poison. A decoction of the crushed seeds acts as a galactagogue and emmenagogue. The powdered seeds are used for asthma and colic. A preparation of the inner bark with sandalwood and *Alyxia* sp. is applied on prickly heat.<sup>[42]</sup>

Research findings indicate that anti-inflammatory activity of Star-fruit extracts help in lowering the skin inflammatory condition. Traditionally, star-fruits are used to relieve stomach discomfort or any ulcer-like disorders. Also, extract of Star-fruit plant leaves have been found to possess anti-ulcerogenic properties. The extracts contain terpenoids (diterpenes and triterpenes), flavonoids and mucilage, which are known to have anti-ulcer activity. The mucilage provides a lining to the gastro-intestinal mucosa, thus helping to avoid damages due to gastritis. Studies reported that Star-fruits contain

proanthocyanins which serves as an antioxidant besides Vitamin C and Gallic acid. The main purpose of antioxidants is to scavenge ROS such as peroxides. Usually, fatty acids are susceptible to oxidative damage by peroxides and hyperperoxides. Consumption of Star-fruits is helpful in removing toxins from the body and aids the immune system in guarding against cancer, ROS damage and lipoperoxidation. In a research work, it had been observed that the discarded residue of star fruit during juice drink processing is a potential source of antioxidants (70% total antioxidants).<sup>[43]</sup>

The ethanol extract of *A. carambola* leaves was examined along with other phytochemical constituents, such as, its hexane, ethyl acetate, butanol fractions and two flavonoids, apigenin-6-C- $\beta$ -l-fucopyranoside and apigenin-6-C-(2''-O- $\alpha$ -l-rhamnopyranosyl)- $\beta$ -l-fucopyranoside to check the anti-inflammatory activity. Based upon the experiment it had been shown up that the ethanol extract was very much helpful in the reduction of edema in a dose-dependent manner, followed on in a maximum inhibition, though rest did not show any significant effect. Stud it had been discovered antimicrobial as well as antifungal activity from the methanol extract of *A. carambola*.<sup>[44]</sup> Antitumor activity, antiulcer activity of the leaves along with the negative inotropic and chronotropic effect were recorded. A new approach was recommended a research that, micronization of the fruit may be supportive in the enhancement of physiological functions of food fibers in fiber-rich functional food applications. Hypoglycemic activity is also one of the health-beneficial characteristics of the leaves extraction of the fruit, *carambola*.<sup>[45-47]</sup>

### Toxicological effects

Star-fruits do possess many magnificent properties. However, this fruit also poses threat to health as it exudes toxic effects in high uremic patients or patients with chronic renal disease due to its high oxalate content. Patients with renal disease are unable to secrete toxic substances out of their body efficiently; as a result of it, they are affected adversely by the oxalates.

### CONCLUSION

*Averrhoa carambola* L. (Oxalidaceae), commonly known as star fruit bears a great significance in traditional medicine. Star-fruit is a good source of nutritionally and medicinally important natural products beneficial for human health. However, due to the oxalate and caramboxin content in the fruits, it is toxic to patients with renal problems. Traditionally, *A. carambola* was used in epistaxis, spermatorrhea, fever, food poisoning, gastroenteritis, malaria, malarial splenomegaly, oliguria, postpartum edema, sore throat, subcalorism and traumatic injury. Pharmacological investigations on *A. carambola* have demonstrated anti-inflammatory, antimicrobial, antifungal, antitumor and anti-ulcer activities. In addition, the plant possesses hypocholesterolemic, hypoglycemic, hypotensive, nephrotoxic, neurotoxic, negative inotropic and

chronotropic effects. It is very much helpful in weight loss because of favorable amount of fiber and low calorie content (30 calorie per fruit). By reason of a good source of vitamin B9 (folic acid), it is also helpful in the reduction of risk management in heart diseases and strokes. Considerable amount of vitamin B-complex in it is also profitable in case of hair growth along with its protection to keep it strong and healthy. As a traditional herbal medicine, it has so many valuable uses. It has been used for hangovers and sunburns as home remedies along with the treatment of cough, fever, ulcers and sore throats. Apart from the fruit, leaves of this plant are also curative. Leaves are primarily supportive to treat stomach ulcers by improving digestion. Ripe fruits are also directed to get relieved in hemorrhoids and hemorrhages. Intake of this fruit also combats blood pressure and lower down the cholesterol level.

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