Review Article

A Review on Actinidia deliciosa

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ABSTRACT

Actinidia deliciosa is also known as chinese gooseberry, Actinidia deliciosa, yangtao, etc in China and consists of 55-60 species. The genus Actinidia plant is widely distributed on the Asian continent. *Actinidia deliciosa* fruit has been acclaimed for its native and medicinal values. It contains several phytoconstituents belonging to category of triterpenoids, flavonoids, phenylpropanoids, quinones and steroids. It has been used as mild laxative and a rich source of vitamins.

Keywords: *Actinidia deliciosa*, Anti inflammatory, antioxidant, hepato protective, anti cancer, anti diabetic, dermatology.

INTRODUCTION

Botanical Description: *Actinidia deliciosa* is assigned under systematic scientific classification based on its taxonomical status[1].

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Sub class	Magnoliidae
Order	Ericales
Super order	Asteranae
Family	Actinidiaceae
Genus	Actinidia
Species	Actinidia deliciosa
Botanical name	Actinidia deliciosa

Growth Habit: In the forests where it is native, the plant is a vigorous, woody, twining vine or climbing shrub. It is not unusual for a healthy vine to cover an area 10 to 15 feet wide, 18 to 24 feet long and 9 to 12 feet high. In cultivation it is supported on a trellising system.

Actinidia deliciosa is borne on a vigorous, woody, twining vine or climbing shrub reaching 9 m.[2]

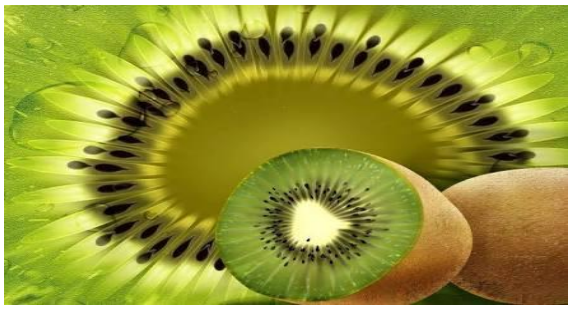
Growing Environment: *Actinidia deliciosa* grows in well drained soil. Fruiting occurs on mature growth (at least a year old), and slows on old wood (over 3 years). Plants are male or female, so cross pollination is necessary for fruit set. For backyard culture, it can be common to grow several vines together in a clump in order to ensure both sexes. Sex can be determined once plants mature and begin flowering.[3]

Morphological Description:

Foliage: The large, deep green, leathery leaves are oval to nearly circular. Its leaves are alternate, long-petioled, deciduous, oval to nearly circular, cordate at the base, 7.5-12.5 cm long. Young leaves are coated with red hairs; mature leaves are dark-green and hairless on the upper surface, downy-white with prominent, light-colored veins beneath.[3]

Flowers: The flowers are fragrant, dioecious or bisexual, borne singly or in 3's in the leaf axils, are 5- to 6-petalled, white at first, changing to buff-yellow, 2.5-5 cm broad, and both sexes have central tufts of many stamens though those of the female flowers with no viable pollen. The flowers also lack nectar. It flowers in November. Male and female flowers appear on different plants (dioecious) and both sexes have to be planted in close proximity for fruit set.[3]

Fruit: The oval, ovoid or oblong fruit is up to 2-2½ inches long, with russet-brown skin densely covered with short, stiff brown hairs. The flesh, firm until fully ripe, is glistening, bright green or sometimes yellow, brownish or off-white, except for the white, succulent center from which radiate many fine, pale lines. Between these lines are scattered minute dark-purple or nearly black seeds, unnoticeable in eating. The flavor is sweet, tart to acid.[3]



Phytochemistry: Gas chromatography- Mass Spectro-photometry and Multidimensional Gas Chromatography olfactometry were utilized to study the aroma profile and the aroma active components of *Actinidia delicosa*. Twelve compounds have been isolated from the root, and identified as β-sitosterol; n-stearic acid; isoscopoletin; 2, 2-dimethyl-6-chromancarboxylic acid; fraxetin; aesculetin; umbelliferone; vanillic acid; protocatechuic acid; vanillic acid 4-O-β-D-glucopyranoside; 5, 7-dihydroxychromone and tachioside.[4]

Physicochemical analysis:

Moisture content: 5 gm of powdered fruit samples were transferred in to a Petri dish and the contents were distributed evenly about 7 .5 cm in diameter and to a depth of 2.5 cm. The tarred samples were air dried in an oven at 1050 C for 5 to 6 hours, kept in desiccators (to cool) and weighed at different time intervals until a constant weight was obtained. The processes were repeated until the difference in two successive weights are less than 1 mg. The difference in weight after drying and initial weight is the moisture content. Respective moisture content (%) for the samples was calculated.[5]

Total ash value: About 5gm of powdered fruit samples were tarred in a crucible and incinerated at 550 ± 10°C in muffle furnace until free from carbon. The crucible was cooled and weighed. The process were repeated and weighed until the difference between two successive weighing is less than 1 mg and recorded the lowest weight. Percentage of total ash was calculated with reference to air-dried substance.[5]

Acid insoluble ash: Ash obtained from total ash was boiled in 25ml of 2N HCl for 5 minutes by covering the Silica dish with a watch glass to prevent spattering. Then the filtrates were filtered using ash less filter paper. The filter paper was transferred into a silica dish and incinerated at 550°C for 2 hours in muffle furnace until free from carbon. Percentage of acid insoluble ash was calculated with reference to air-dried substance.[5]

Water soluble ash: Weighed 5 gm of powdered fruit samples were dissolved in about 200 ml of distilled water and connected to reflux condenser for 1 hour over low flame with occasional mixing. The samples were later cooled and filtered in a Whatman No 1 filter paper. The filter paper was washed and tarred in an aluminum dish. Evaporate on a steam bath and transfer to 100°C air oven and dry for 2 hours. Samples were dried again for 30 minutes, cooled in desiccators and weighed. The experiment was repeated twice, and the average value was taken (Handbook of Food Analysis, 1984).[5]

Alcohol soluble extraction: 5 gm of powdered fruit samples were macerated with 100 ml of alcohol in a Stoppered flask with frequent shaking during first 6 hrs and allowed to stand for 18 hrs. It was filtered after 24 hrs. 25 ml of the filtrate was evaporated in a tarred dish at 105°C and weighed. Alcohol soluble extractive

values were calculated. The experiment was repeated twice, and the average value was taken (WHO, 1998). [5]

Traditional Uses:

It has been reported that folk remedy for adult diseases, such as potent anti-hepatotoxic, anti-pyorrheal and gingival inflammation, was observed in the roots of *Actinidia deliciosa*.[6]

The genus *Actinidia (Actinidiaceae*) are widely used in Chinese folk medicines to treat such diseases as hepatitis, edema, rheumatoid arthritis, gastric cancer and breast cancer etc.[7]

Actinidia deliciosa is distributed in west China, and showed to have anti-tumor and protective effects on acute hepatic injury in biological arrays.[8]

Actinidia deliciosa is often reported to have mild laxative effects, due to its significant levels of dietary fiber.[9]

Actinidia deliciosa components, possibly involving vitamin E and omega-3 fatty acids from its numerous edible seeds, have potential properties of a natural blood thinner.[10]

Actinidia deliciosa is a natural source of carotenoids, such as provitamin A beta-carotene[11], lutein and zeaxanthin.[12]

The fruits, stems and roots are diuretic, febrifuge and sedative. They are used in the treatment of stones in the urinary tract, rheumatoid arthralgia, cancers of the liver and oesophagus.[13]

Usually *Actinidia deliciosa* is eaten fresh; however it can also used in beverages, desserts, and as a flavoring. The fruits are very high in vitamin C, along with containing vitamins A and E, also it contains considerable potassium.[13]

It is a rich source of vitamin C and is a good source of flavonoid antioxidants. The *Actinidia deliciosa* seed oil contains on average 62% alpha-linolenic acid, an omega-3 fatty acid.[14]

Inositol found in Actinidia deliciosa functions as a precursor of an intracellular second messenger system. It is beneficial in the treatment of depression.[17]

THERAPEUTIC USES

***Actinidia deliciosa* changes intestinal microbial profile:**

Actinidia deliciosa fruit is high in pectic polysaccharides and dietary fiber.

The ingestion of *Actinidia deliciosa* will affect intestinal microbiota populations, namely Lactobacillus, Bacteroides, Clostridium, Bifidobacterium, and Enterococcus.

The method used in this study includes freeze drying the fruit given to each of the six subjects daily for four days. Faecal samples were collected before, during and after fruit consumption. The faecal bacteria were enumerated by qPCR and RT qPCR methods.

Obtained result showed the effect of the *Actinidia deliciosa* fruit on intestinal microbiota profile varied between individuals; in general, the *Actinidia deliciosa* demonstrated a prebiotic effect of promoting the content of faecal lactobacilli and bifidobacteria (as compared to the baselines of the same individual before consumption) for as long as the fruit was consumed. The effect was however transient, the levels of the two bacteria returned near to that of the baselines upon cessation of consumption. The study implies that *Actinidia deliciosa* can act as a prebiotic in selectively enhancing the growth of intestinal lactic acid bacteria (lactobacilli and bifidobacteria) and causing perturbation in the population of Clostridium and Bacteriodes. The extent of their prebiotic effectiveness was depending on individual. The general trend is that *Actinidia deliciosa* consumption enhanced the population of Bifidobacterium and Lactobacillus within 24 hours, and the effect last only during the consumption of the fruit.[15]

Improved sleep quality in adults with sleep problems

The aim of this study was to evaluate the effects of *Actinidia deliciosa* on sleep patterns, including sleep onset, duration, and quality. In this study, applied free-living, self-controlled diet design.

Twenty-four subjects (2 males, 22 females) 20 to 55 years of age consumed 2 *Actinidia deliciosa* 1 hour before bedtime nightly for 4 weeks. The Chinese version of the Pittsburgh Sleep Quality Index (CPSQI), a 3-day sleep diary, and the Actigraph sleep/activity logger watch were used to assess the subjective and objective parameters of sleep quality, including time to bed, time of sleep onset, waking time after sleep onset, time of getting up, total sleep time, and self-reported sleep quality and sleep onset latency,waking time after sleep onset, total sleep time, and sleep efficiency before and after the intervention.

After 4 weeks of *Actinidia deliciosa* consumption, the subjective CPSQI score, waking time after sleep onset, and sleep onset latency were significantly decreased and Total sleep time and sleep efficiency were significantly increased.

Hence *Actinidia deliciosa* consumption improves sleep onset, duration, and efficiency in adults with self-reported sleep disturbances.[16]

Cancer

Actinidia deliciosa contains an antimutagenic component, helping to prevent mutations of genes that may initiate the cancer process. The presence of glutathione may account for the reduction. Carcinogenic nitrates are formed during the smoking or barbecuing of foods. When nitrates are ingested a process called nitrosation occurs, in which free radical nitrosamines are foremed that may lead to the formation of gastric or other cancers.

The amino acid arginine, present in *Actinidia deliciosa*, is being looked at by cardiologists to improve post angioplasty blood flow and actually prevent the formation or reformation of plaque in the arteries. This fruit is ranked as having the fourth highest natural antioxidant potential next to the red fruits containing high levels of beta-carotene. Lutein, an important phyto chemical foiund in *Actinidia deliciosa,* has been linked to the prevention of prostate and lung cancer.[17]

Cardiovascular disease

Platelet hyperactivity is one of the most important risk factors responsible for the incidence of cardiovascular disease. There are many nutritive and non nutritive compounds present in the fruits and vegetables that may effect platelet function in various ways. The recent discovery of anti-platelet factors in *Actinidia deliciosa* provides a new dietary means as a preventive or therapeutic stratergy to favorably modify platelet activity. This fruit is rich arginine and glutamate. Arginine may help promote an increase in arteriolar dilation, working as a vasodilator and improving blood flow important for heart health. Fruits thin up blood, reduce clotting by an average of 18% and lower your fat in the blood by an average of 15%. [17]

Antidiabetic activity

Inositol, a sugar alcohol naturally occurring in *Actinidia deliciosa*, plays a positive role in regulating diabetes. Inositol supplements improve nerve conduction velocity in diabetic neuropathy. Inositol plays a role in intracellular responses to hormones and neurotransmitters. It acts as a second messenger in cell signaling process.[17]

Gastric and Hepato protective activity

The aim of this study is to evaluate the gastric- and hepatic protective effects of *Actinidia deliciosa* extract against toxicity of indomethacin in mice.

36 Swiss albino mice (25–30 g) were randomly divided into six groups. The first group served as control and was injected intraperitonieal with distilled water, animals of the second group were injected with vehicle of Indomethacin (sodium bicarbonate, i.p.) and served as vehicle -Indomethacin group and those of the third group was injected with Indomethacin. One hour before Indomethacin injection, fourth group was injected with pantoprazole, and animals of the fifth and sixth group were injected with fruit extract. *Actinidia deliciosa* extract was found to be safe up to 4000 mg/kg when *Actinidia deliciosa* administrated i.p. in Swiss albino mice.

Indomethacin treatment induced histological lesions in both gastric and hepatic tissue as revealed by light microscope. Gastric sections showed ulcerated and erosion of mucosal layers with congested dilated blood vessels in submucosal layer and liver sectios showed marked vacuolated hepatocyte, congested dilated vascular channels, and dense aggregation of inflammatory cells. Pretreatment with fruit extract prior Indomethacin administration resulted in marked ameliorations of the gastric and hepatic lesions.

We can conclude that *Actinidia deliciosa* extract is useful in combating tissue injury caused by indomethacin toxicity and protect gastric and hepatic tissues from toxicity of indomethacin.[18]

Dermatological Activity- Burn treatment

Two recent rat studies demonstrated an intriguing capacity for a dressing prepared from slices of fresh *Actinidia deliciosa* to promote healing of acute burn wounds. [19]

Specifically, wound surface area was significantly smaller in rats administered *Actinidia deliciosa* dressings, compared with controls, and dry scars detached more rapidly in the Actinidia deliciosa-treated group. Additionally, dramatic antibacterial and angiogenic actions of *Actinidia deliciosa* were observed, compared with controls and with a group of rats treated with silver sulfadiazine cream, an antibacterial ointment used in topical burn management.[20]

It was noted by the investigators that among the *Actinidia deliciosa*-treated rodents, there were no positive cultures for Pseudomonas, Streptococcus, or Staphylococcus. There were,

however, inconsistent results between the 2 studies when the effect of *Actinidia deliciosa* on blood vessel count and inflammation was evaluated. These disparities likely were due to differences in experimental protocols. A suggested mechanism for the improved wound debridement involved the beneficial proteolytic action of actinidin and other degradative enzymes known to be present in *Actinidia deliciosa*.

Components responsible for the antimicrobial, angiogenic, and anti-inflammatory actions of the *Actinidia deliciosa* were not determined. Further characterization of this wound-healing effect of *Actinidia deliciosa* dressings is warranted and should include determining what types of wounds exhibit improved healing and whether different approaches to preparation of the *Actinidia deliciosa*-based dressings are effective. The fractions/components of the Actinidia deliciosa that are responsible for the various beneficial outcomes need to be identified, and the mechanisms underlying the improved healing need to be clarified. There remains a considerable challenge in translating this wound-healing action of *Actinidia deliciosa* to the practical clinical care of human burn patients.[21]

Antioxidant Activity

The is well known to contain anti-oxidants. In this study, we investigated the anti-oxidant effects of kiwi extract on carbon tetrachloride (CCl4) induced liver injury in BALB/c mice. The radical scavenging effect of 80% methanol extract of Halla-Gold fruit was observed. For the animal study, mice were randomly divided into four groups: normal group, CCl4-induced model group, fuit extract administered group, and silymarin treated group.

The fruit extract was provided daily for 10 days. At the 24 h after last administration, CCl4 was injected. The extract showed strong inhibitory effect of DPPH radicals and superoxide scavenging. In animal study, administration of CCl4 resulted in significantly elevated plasma levels of ALT and AST but they decreased in the fruit extract pretreated group. Anti-oxidant enzymes such as GSH-px and GSH-rd were restored in the fruitextract treatment group. Histopathological degeneration was also prevented in the kiwi extract treated group compared with of the control group, which exhibited CCl4-induced hepatotoxicity. On the basis of the obtained results, it can be concluded that the extract showed protective effects, not only as anti-oxidant effects, but also in the protection of hepatotoxicity in CCl4-intoxicated mice.[22]

Anti-inflammatory activity

There is much research interest in identifying dietary anti-inflammatory agents that may retard chronic disease development and other degenerative processes. *Actinidia deliciosa* and its constituents have been the subject of such investigations.

Few animal studies evaluating *Actinidia deliciosa*'s anti-inflammatory effects have been reported. An extract of *Actinidia* polygama fruit demonstrated anti-inflammatory activity in several animal models, an effect in part attributed to inhibition of inducible nitric oxide synthase and cyclooxygenase 2 enzyme expression. In addition, an A polygama extract inhibited airway inflammation and hyperresponsiveness in a murine model of asthma.[21]

CONCLUSION

Actinidia deliciosa belongs to the genus *Actinidia* (*Actinidiaceae*) and is derived from a deciduous woody, fruiting vine. It is composed of different species and cultivars that exhibit a variety of characteristics and sensory attributes. *Actinidia deliciosa* plants have been grown for centuries in China, where they are known as mihoutau. *Actinidia deliciosa* plant seeds were brought to New Zealand in the early 20th century, where it was eventually domesticated and sold worldwide. Currently, commercial growth of the fruit has spread to many countries including the United States, Italy, Chile, France, Greece, and Japan. Actinidia deliciosa extracts have been reportedly used in traditional Chinesemedicine for relief of symptoms of numerous disorders. In light of growing consumer acceptance of *Actinidia deliciosa* worldwide, there has been an increased attention given to identifying health benefits associated with its consumption. Potential benefits include a rich source of antioxidants, improvement of gastrointestinal laxation, lowering of blood lipid levels, and alleviation of skin disorders. Some individuals report allergic symptoms to *Actinidia deliciosa*, and a considerable research effort is being focused on characterizing fruit's allergenicity among various populations of people. *Actinidia deliciosa* not only is rich in vitamin C but also is a good source of other nutrients such as folate, potassium, and dietary fiber. This fruit's content of nutrients and biologically active phytochemicals has stimulated investigations

into its antioxidant and anti-inflammatory actions that might then help prevent cardiovascular disease, cancer, and other degenerative disorders.

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