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Ethnophamacological importance of *Actinidia deliciosa*: A literature based review

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Abstract
Herbs have been used by people for longer than we have been keeping written record. Originally they were found in the wild, by the gatherers and used for a lot of different things. They were used to flavour food, as a source of nutrition, as medicines. Kiwifruit is one of the superb fruit gifted by god to human being having composition of all the crucial phytochemicals and nutrients that are required for good health. *Actinidia deliciosa* is a sub-family of the genus *Actinidia*, which is also known as Chinese gooseberry, kiwifruit, yangtao, etc. in China, and consists of 55-60 species. *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. *Actinidia deliciosa* has thereby recently acquired interest due to its attractive potential application in indigenous drugs. It contains high levels of bioactive compounds such as vitamin C, vitamin E, flavonoids, carotenoids and minerals. Kiwifruits show a wide diversity in size, shape, fuzziness, flesh and peel colour and flavour. The present review highlights a literature on taxonomical, botanical, phytoconstituents, and pharmacological discussion on *Actinidia deliciosa*.

Keywords: *Actinidia deliciosa*, kiwifruit, nutrients, actinidin, phytochemicals, flavonoids, gas chromatography-olfactometry

Introduction
The plant product or natural products show an important role in diseases prevention and treatment through the enhancement of antioxidant activity, inhibition of bacterial growth, and modulation of genetic pathways. The therapeutics role of number of plants in diseases management is still being enthusiastically researched due to their less side effect and affordable properties. It has been accepted that drugs based on Allopathy are expensive and also exhibit toxic effect on normal tissues and on various biological activities. It is a largely accepted fact that numerous pharmacologically active drugs are derived from natural resources including medicinal plants.

The use of traditional medicine and medicinal plants in most developing countries, as a normative basis for the maintenance of good health, has been widely observed. In the last century, roughly 121 pharmaceutical products have been discovered based on the information obtained from the traditional healers. Chemical principles from natural sources have become much simpler and have contributed significantly to the development of new drugs from medicinal plants. And because of these facts the world market for plant-derived chemicals - pharmaceuticals, fragrances, flavours, and colour ingredients, alone exceeds several billion dollars per year. Medicinal plants are rich source of novel drugs that forms the ingredients in traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates, bioactive principles and lead compounds in synthetic drugs. WHO pointed out that more than 80% of world's population depends on plants to meet their primary health care needs.

Kiwifruit is one of the few new fruit crops successfully adopted by international markets in recent years. It has become a high value export crop for a number of countries including New Zealand, Italy, and Chile. The success of kiwifruit has been largely based on a single cultivar, *Actinidia deliciosa* 'Hayward', which has a distinctive appearance and flavour, compared with other fruit types, as well as health benefits from high concentrations of vitamin C and fibre. In the past decade, several new kiwifruit cultivars have been developed and released to complement sales of 'Hayward' fruit in world markets. However, to accelerate the development of further new cultivars, a greater understanding of the metabolic control of major quality traits in kiwifruit is required.

Sweetness is the single most important quality trait for kiwifruit as it influences overall fruit flavour (sugar/acid balance, perception of volatiles), consumer acceptability, and grower returns. While sucrose (Suc) and planteose are the major sugars transported to fruit during development, adequate storage of soluble sugars as starch/dry matter (DM) reserves is essential to produce an acceptably flavoured kiwifruit berry. Starch metabolism in kiwifruit is a complex, dynamic process, characterized by simultaneous starch accumulation and degradation. Net starch accumulation does not occur until the fruit has completed cell division, while net starch degradation mainly occurs after fruit harvest and, by the time the fruit is eating ripe, almost all starch has been converted into soluble sugars.

The earliest recorded mentions of kiwifruit (*Actinidia deliciosa*) in the world beyond China were the result of adventurous European botanists traveling through China in the 1700s and 1800s. These explorers, among them the Scottish botanist Robert Fortune, famous for introducing tea from China to India, brought the earliest samples of the kiwifruit vine to Europe, where interest in the plant lay in its novelty value for keen plant collectors, rather than in the

crop it produced. For example, in 1904, a London-based nursery firm known as James Veitch & Sons offered the vines as a novelty for sale, with the plant having a great value as a pillar or pergola plant in the open garden. The fruit of this novelty plant was described as being the size of a walnut with the flavour of ripe gooseberries. While the novelty value of this exotic vine was being exploited in Europe in the nineteenth and early twentieth century, its existence in China had been recorded as early as the twelfth century. One of the earliest descriptions of the plant and fruit (known then in China as mihoutao) was credited to an author in the twelfth century Song Dynasty, who described mihoutao as "found in the valleys of the mountains; it is a vine with round, pubescent leaves, which grows by climbing over trees; in shape and size the fruit resembles an egg; its skin is brown; after the first frosts, it becomes sweet and edible.

History

The origin of kiwifruit is supposed to be the Yangtze Valley of China of eastern Asia. In 1904, cultivation of Kiwi from seeds was started in New Zealand and from single seed two female and one male plant was grown. The familiar cultivar *Actinidia deliciosa* 'Hayward' was developed by Hayward Wright in New Zealand around 1924 but commercial planting was started in New Zealand in the late 1940s. In 1959, Growers named it kiwifruit. Kiwi is the name of New Zealand's national bird. In 1962, it was exported to USA. For the past three decades kiwifruit has been increasingly available worldwide. In 1977, seedling was started in Korea and marketing of this Korean kiwifruit was started in 1981. In 1981, allergic activity of kiwi was reported and after 1981 various pharmacological activities such as anti-asthmatic, anti-inflammatory, anti-HIV, anti-platelet and anti-hypertensive were reported. Thus, kiwi is cultivated for its nutritional benefits and useful medicinal properties.

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 9m.

Table 1: Taxonomical classification

Domain	**Eukrya**
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Magnoliidae
Order	Ericales
Superorder	Asteranae
Family	Actinidiaceae
Genus	*Actinidia*
Species	*A. deliciosa*
Binomial name	*Actinidia deliciosa*

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 yrs). 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.

Fig 1: *Actinidia deliciosa* plant

Fig 2: *Actinidia deliciosa* leaves

Fig 3: *Actinidia deliciosa* fruits

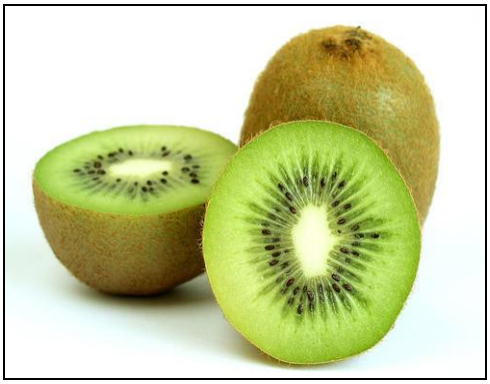

Fig 4: *Actinidia deliciosa* fruits

Fig 5: *Actinidia deliciosa* flower

Cultivation

Plants perform best when grown in light, deep and well-drained soil with pH of 6.0 (mildly acidic) in a location that receives full sun is more favourable for the growth. For optimal growth, there must be adequate levels of organic matter in the soil, heavy clay and calcareous soil must be avoided. Kiwi vines are very sensitive to both flooding and water deficit, irrigation is must even in humid climates.

Warm, humid and temperate regions with a rainfall of 50-70 inches are most favourable for growth of plant in southeast China. Winter temperature may reach - 15 ^{0}C. High wind during storms can break shoots off arms, cause surface blemishes therefore natural or artificial windbreaks must be used. Frost in spring and fall is a problem in marginal areas, since kiwifruit requires 220 day growing season. Degradation of vitamin C increases with increase in dry air temperature.

Kiwifruit should store at cooled to near 0 ^{0}C (32 ^{0}F) as soon as possible after harvest. Forced air cooling is preferred. The recommended storage conditions are 1 to 2 % O_2 with 3 to 5% CO_2 at 0 ^{0}C.

Traditional uses

In the region of western China due to the presence of fibers, kiwi fruit is often reported to have mild laxative effect and useful in hepatic injury and gingival inflammation. Roots of the kiwi plant have been used as potent anti-hepatotoxic and anti-pyorrheal. It has been found beneficial in the treatment of hepatitis, edema, rheumatoid arthritis, gastric cancer and breast cancer. Seeds of kiwi plant have the property of blood thinner due to the presence of vitamin E and omega-3 fatty acids. Different parts of kiwi plant such as fruit, stems and roots have been used in the treatment of stones in urinary tract, rheumatoid arthralgia, cancers of esophagus and liver.

Cuisine uses

Due to presence of actinidin enzyme it can be used as meat tenderizer. It can be used for making wine, jams and cocktails. It can be used in sea food, chicken and ham.

Side effects associated with kiwifruit

The most common side effect is allergy to kiwi, which can be characterized by local mouth irritation to anaphylaxis. Acute pancreatitis has also been reported. Due to high levels of vitamin C, E and potassium it may be capable of altering triglycerides level.

Morphology

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-coloured veins beneath.

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, 2.5-5cm 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.

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 centre from which radiate many fine, pale lines. Between these lines are scattered minute dark-purple or nearly black seeds, unnoticeable in eating. The flavour is sweet, tart to acid.

Sex determination

Differences in anatomy and morphology of the kiwifruit leaves and leaf petioles might play a considerable role in the sex-determination. Three months after bud break (June), the kiwifruit leaves of both male and female plants, grown on the vegetative and generative shoots showed different leaf area (128.6 ± 13.45 cm^2 in male and 104.5 ± 4.02 cm^2 in female plants) and shape. The most frequently leaf shape was determined as "folium cordatum" and "folium rotundata-cordatum".

Higher values of total leaf thickness of the female leaves (190 ± 3.84 µm) in comparison to male leaves (174 ± 3.52 µm) were estimated, resulting in the thicker adaxial leaf epidermis and especially in thicker palisade parenchyma in female leaves (136 ± 2.76 µm in comparison to 104 ± 1.61 µm in male leaves). Typically bifacial leaves were observed in both male and female leaves.

Anomocytic stomata in hypostomatic leaves were found. The reticulate venation appears to be the main type of leaf venation. Stalled stellate multicellular trichomes on the abaxial leaf side were frequently observed in the leaves of both sexes. No important differences between male and female plants were found in the structures of vascular system in leaves and leaf petioles. Thus leaf thickness and surface morphology of adaxial leaf epidermis can be considered as important structural parameters in the sex determination.

Production

The most widely planted kiwifruit cultivar is the fuzzy kiwifruit *A. Deliciosa* - 'Hayward'. 'Hayward' accounts for about half of kiwifruit cultivation throughout the world. 'Hayward' kiwifruit also represents about 90% to 95% of the kiwifruit traded internationally. The fuzzy kiwifruit *A. deliciosa* is commercially the most important crop and its total production accounts for about 1.8 million tons per year. However, internationally kiwifruit is a minor crop representing about 0.2% to 0.3% of total fresh fruit production. In terms of "marketable gross production" (essentially, crop value), kiwifruit is the sixth most valuable fruit crop after citrus, apples, table grapes, peaches/nectarines, and pears. China is the largest producer

of kiwifruit followed by Italy, New Zealand, Chile and Greece. Kiwifruit is the national fruit of China. Until recently, China was not a major producer of kiwifruit, as it was traditionally collected from the wild. In China, it is grown mainly in the mountainous area upstream of the River Yangtze. In New Zealand, nearly about 2,500 farmers are associated with the kiwifruit production and they harvest about 3.7 billion kiwifruits per year. New Zealand kiwifruits are marketed in about 55 countries under the brand name Zespri. In New Zealand, kiwifruit is mainly cultivated in the Bay of Plenty (North Island). This area receives enough sunlight and rainfall, remains cool in winter and also there is no risk of frost in spring, thus provides ideal conditions for kiwifruit plantation. Although, Italy is one of the biggest producers of kiwifruit, the industry there is still relatively small when considered in context of total Italian fruit production. In Italy, kiwifruit accounts for about 3.5% of the total area in fruit crops and about 4% of the total fruit production by weight. Currently about 1.5-1.6 million MT of kiwifruit are produced each year, about two-third of current kiwifruit plantings are in the northern hemisphere and one-third in the southern hemisphere.

Health benefits

In the recent years, food scientists and nutrition specialists agree that fruits and vegetables, consumed daily, contribute to reducing risks of certain diseases, including cancer and cardio and cerebrovascular diseases. The various anti-oxidants (polyphenols, ascorbic acid, carotenoids, and tocopherols) present in fruits and vegetables contribute to these beneficial effects. These anti-oxidants prevent diseases by scavenging radicals or by suppressing formation of free radicals by binding to metal ions, reducing hydrogen peroxide and quenching superoxide and singlet oxygen. Consumption of kiwifruit has been found to have a preventive effect against certain cancers and cardiovascular disease. Different cancers, especially cancers of the digestive system (mainly stomach cancer), lung and liver have been treated with kiwifruit prescriptions due to its cytotoxic and anti-oxidant activities. Due to its unique composition, kiwifruit has the potential to lower the risk of cardiovascular disease.

Phytochemistry

Gas Chromatography-Mass Spectrophotometry (GC-MS) and Multidimensional Gas Chromatography-Olfactometry (GC/GC-O) were utilized to study the aroma profile and the aroma active components of kiwifruit. Twelve compounds have been isolated from the root of *A. deliciosa*, and identified as (1) β-sitosterol, (2) n-stearic acid, (3) isoscopoletin, (4) 2, 2-dimethyl-6-chromancarboxylic acid, (5) fraxetin, (6) aesculetin, (7) umbelliferone, (8) vanillic acid, (9) protocatechuic acid, (10) vanillic acid 4-O-β-D-glucopyranoside, (11) 5, 7-dihydroxychromone and (12) tachioside. Previous studies reported the isolation of triterpenoids, flavonoids, phenylpropanoids, quinones and steroids from the genus. The phenol and flavonoid contents were quantified. Phytochemical analysis of kiwi peel crude extracts led to the isolation of vitamin E, 2, 8-dimethyl-2-(4, 8, 12-trimethyltridec-11-enyl) chroman-6-ol, as well as alpha- and delta-tocopherol, 7 sterols, the triterpene ursolic acid, chlorogenic acid, and 11 flavonoids.

Chemical fractionation of pulp crude extracts revealed isolation of two caffeic acid glucosyl derivatives and two coumarin glycosides, besides the three vitamin E, beta-sitosterol, stigmasterol, and its Delta (7) isomer, campesterol, chlorogenic acid, and some flavone and flavanol molecules.

The flavour of kiwifruit appears to be a subtle blend of several volatile components. The fruit softens considerably during ripening, which produces a large number of volatile compounds. Ten components were quantified by Gas chromatography-Mass Spectrometry (GC-MS) and Multidimensional Gas Chromatography-Olfactometry (GC/GC-O) as constituents of the kiwifruit including 3-penten-2-ol, 3-hydroxy-2-butanone, 3-methyl-2-butenal, 2-hexanol, nonanal, 3-methyl-1-butanol, 2-methyl-1-butanol, 3-methyl-2-butanone, 3-methyl 3-buten-2-one, and octane.

The three major acids present in kiwifruit are citrate, quinate, and malate. Kiwifruit contains 0.9-2.5% total acidity with 40-50% as citrate, 40-50% as quinate, and 10% as malate. The citrate and quinate is highest in inner and outer pericarp, respectively. The core has the lowest total acid content; predominantly citrate is present at the time of harvest. The storage temperature affects the balance of the three major acids in the fruit.

Minerals

The mineral composition of the kiwiberry is quite variable and depends on its genetic features (cultivar) and growing conditions such as soil and weather. The order of the relative quantity of macroelements found in kiwiberry is K > Ca > P > Mg > Na, and of microelements is Fe > Zn > B > Mn > Cu. On the basis of available research, the kiwiberry is a good source of potassium, calcium and magnesium. Depending on the cultivar and year of cultivation, the kiwiberry may contain 162.7–382 mg K/100 g FW, 51.5–120.1 mg Ca/100 g FW, 31.7–80.2 mg P/100 g FW, 10.0–23.2 mg Mg/100 g FW, and just 1.2–9.6 mg sodium. The concentrations of potassium and magnesium in the kiwiberry are similar to the levels found in Hayward kiwifruit, while kiwiberry calcium concentration is approximately twice that of kiwifruit.

The kiwiberry is also a significant source of microelements, containing 0.31-1.15 mg Fe/100 g FW, 0.18–1.45 mg Zn/100 g FW, 0.18–0.48 mg B/100 g FW, 0.03-0.24 mg Mn/100 g FW and 0.05–0.16 mg Cu/100 g FW. These values usually make the kiwiberry a richer or similar source of these minerals than kiwifruit. According to Japanese studies, the content of K, Ca, Mg, Mn and Zn in *A. arguta* fruit is higher than in Hayward kiwifruit. Similar results for *A. arguta* have been obtained by Martens and for *A. arguta* and *A. purpurea* hybrids by Bieniek. The consistent correlation between micronutrient proportional concentrations of fruits of the *Actinidia* genus suggests that this is dependent more on its genetic make-up than on growing conditions.

Amino and fatty acids

The kiwiberry also contains amino acids. The content of total amino acids in the kiwiberry is 601–1220 mg/100 g FW, of which 199–414 mg are essential amino acids. The authors identify about 20 different amino acids in the kiwiberry, with the two major amino acids being glutamic acid and aspartic acid.

The lipid content of the kiwiberry is similar to Hayward kiwifruit and is restricted to the seeds almost entirely, with a small level of membrane-associated lipids located within the

flesh. The defined fatty acids include 13.9–30.5% saturated fatty acids and 70.4–85.8% unsaturated fatty acids. The analysis of fatty acids shows that the major fatty acids in the three kiwiberry cultivars are palmitic acid as a saturated fatty acid and α-linoleic acid as an unsaturated fatty acid. This makes its oil of interest for nutritional uses.

Pigments

Depending on the species and cultivar, *Actinidia* fruit also contain substantial amounts of different pigments, including carotenoids, chlorophylls, and anthocyanins. Lutein and β-carotene, both potent antioxidants, are the most concentrated carotenoids of *Actinidia* fruit. Among commercial *Actinidia* species, the kiwiberry contains the highest levels of lutein and β-carotene, up to 0.93 and 0.29 mg/100 g FW, respectively. Occurring in smaller amounts are zeaxanthin (0.02–0.04 mg/100 g FW), violaxanthin (0.01–0.12 mg/100 g FW) and trace amounts of α-carotene. Significant quantitative differences in these compounds reported in Europe and Japan suggest a significant influence of climate and genetic make-up on fruit pigment composition. Some red fleshed kiwiberry species and cultivars (*e.g.*, *A. melanandra* and *A. arguta* or its hybrids) also contain small amounts of anthocyanins. Available research indicates that the total anthocyanin content was the highest in *A. melanandra* (50.4–98.5 μg/100 g FW) and red-fleshed *A. arguta* cultivars (161.2–206.1 μg/100 g FW), where anthocyanins are present in the skin, pericarp and core of the fruits. Other research confirms the presence of anthocyanins in some green-fleshed kiwiberry cultivars as well (up to 129.8 μg /g DW). Recent research identifies cyanidin-3-O-sambubioside as the major anthocyanin in the Ken's Red cultivar of kiwiberry. Another pigment closely associated with the fruit of *Actinidia* is chlorophyll. The kiwiberry, containing between 2.6 and 4.2 mg/100 g FW, has up to 3.2 times the chlorophyll concentration of kiwifruit (1.3–2.7 mg/100 g FW). Chlorophyll *a* is the predominant form in both kiwifruit and kiwiberry.

Given the expanding worldwide acceptance and consumption of the kiwiberry, there has been increased interest in identifying, both quantitatively and qualitatively, those health-promoting constituents derived from the fruit. In recent years, there has been a significant increase in the volume of published research on the subject of the kiwiberry's nutritional value and health benefits. Much of this research points to and confirms a rich composition of health-promoting ingredients. The kiwiberry (*A. arguta*) contains over 20 essential nutrients, making it one of the most nutrient-dense fruits there is. In almost every case, the kiwiberry is more nutrient dense in vitamins, minerals, pigments and phenols than kiwifruit, and is one of the richest sources of both vitamin C and lutein among commonly consumed fruits. The kiwiberry is also considered to be the richest dietary source of myo-inositol (vit B_8). Along with significant amounts of phenolics and essential minerals (primarily potassium, calcium and zinc), it is clear why kiwiberry deserves its status as a 'health food' or 'superfood'. Some of these chemicals (mainly vitamin C and phenolics) possess antioxidant activity. Indeed, considerable research now points to the kiwiberry being a promising natural anti-oxidant. As such, it could prove helpful in preventing diseases caused by free radicals such as Type I diabetes and certain cardiovascular-related diseases. Early research is already confirming the kiwiberry's potential in treating hypercholesterolemia, certain cancer types and some gastrointestinal-related diseases. Additional health-related properties of the kiwiberry, including immunologic benefits, have not yet been fully researched or described, but such research is certainly warranted given this fruit's growing popularity.

Sugars

Kiwiberries contain sugars, making them a sweet and enjoyable treat. Just like other fruit, kiwiberries are a great source of natural sugars making them a tempting snack for younger palates and sweet toothed adults. Common sugars found in the kiwiberry are glucose, fructose, and sucrose. These naturally occurring sugars are healthy, just as in any other sweet fruit, unless consumed in excessive quantities.

Allergies

The actinidain found in kiwifruit can be an allergen for some individuals, including children. The most common symptoms are unpleasant itching and soreness of the mouth, with wheezing as the most common severe symptom; anaphylaxis may occur.

Ethnopharmacology

Anti-oxidant activity

This is well known to contain anti-oxidants. In this study, we investigated the anti-oxidant effects of kiwi extract on carbon tetrachloride (CCl_4) 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, CCl_4-induced model group, fruit extract administered group, and silymarin treated group. The fruit extract was provided daily for 10 days. At the 24 h after last administration, CCl_4 was injected. The extract showed strong inhibitory effect of DPPH radicals and superoxide scavenging. In animal study, administration of CCl_4 resulted in significantly elevated plasma levels of ALT and AST but they decreased in the fruit extract pre-treated group. Anti-oxidant enzymes such as GSH-px and GSH-rd were restored in the fruit extract treatment group. Histopathological degeneration was also prevented in the kiwi extract treated group compared with of the control group, which exhibited CCl_4-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 CCl_4-intoxicated mice.

Anti-diabetic 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.

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 has 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 expressions. In addition, a polygama extract inhibited airway inflammation and hyper responsiveness in a murine model of asthma.

Cancer

Actinidia deliciosa contains an anti-mutagenic 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 formed 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 phytochemical found in *Actinidia deliciosa,* has been linked to the prevention of prostate and lung cancer.

Gastric and Hepatoprotective 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 (25-30g) were randomly divided into six groups. The first group served as control and was injected intraperitonial 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 sections showed marked vacuolated hepatocyte, congested dilated vascular channels, and dense aggregation of inflammatory cells. Pre-treatment 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.

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. 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. 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 anti-microbial, 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 *A. deliciosa* to the practical clinical care of human burn patients.

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, they 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 hr 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.

Conclusion

Medicinal plants served as a platform for ancient Ayurvedic system of medicine. In the present scenario, herbal therapeutics is gaining momentum in pharmacological applications and as molecular targets in the drug development. The emerging trend in rising incidence of diseases and associated complications with commercial medications poses a serious threat to mankind. Naturopathic treatments offer respite from the high cost of expensive drugs as well as in being comparatively safe with less side effects. It is estimated that nearly 80% of population depends on the natural remedies for health care. Plants are a valuable source of a number of bioactive compounds like alkaloids, quinine, paclitaxel, opium alkaloids, quinine,

atropine and cardiac glycosides (digitalis, ouabain) to name a few. Thus, it becomes very important to screen plants with pharmacological significance as a basis for the development of newer and more effective therapeutics.

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. Potential benefits include a rich source of anti-oxidants, 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 allergeni city among various populations of people.

Fruits and vegetables have been consumed by humans since ancient times. Scientific investigations have proved that an increased consumption of fruits and vegetables is known to reduce various diseases. Kiwi is one of the most popular delicious foods having a large number of medicinal properties. This tasty fruit is liked by people of all ages. In this review, we made humble attempt to collect all the necessary information on kiwi, which may help the researchers or pharmaceutical company to develop new herbal formulations. It is an excellent package of bioactive compounds, nutrients and minerals, which make it a sound dietary supplement. It is useful in management of various diseases such as inflammation, HIV, hypertension, asthma, cancer and diabetes. Traditionally, it is used as diuretic, mild laxative and anti-hepatotoxic. It exhibits excellent anti-oxidant potential. It is very clear that kiwi has tremendous popularity now and also holds extraordinary promise for the future. Clinical trials need to be carried out to exploit the therapeutic utility of kiwi in combating various diseases.

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The authors declare no conflict of interest.

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