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MEDICINAL POTENTIAL AND PHYTOPHARMACOLOGY OF *ACTNIDIA DELECIOSA*

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ABSTRACT

Kiwi fruit 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. Scientifically, it is known as *Actnidia deleciosa* belonging to Actinidiaceae family. It is originated from China and one of the most popular fruit in western hemisphere. It is the national fruit of China. The word Kiwi derives from New Zealand's national bird name Kiwi. It is an excellent package of bioactive compounds, nutrients and minerals, which make it a sound dietary supplement. It is used as an energy booster and has valuable medicinal properties like anti-oxidant, anti-inflammatory, anti-HIV, anti-microbial, anti-proliferative, anti-asthmatic, anti-platelet, anti-hypertensive etc. Seeds of Kiwi plant have blood thinner property due to the presence of vitamin E and omega-3 fatty acids. It can be used as meat tenderizer due to presence of actinidin enzyme. Traditionally, it was consumed as fruit. It is now being recognized as a medicinal fruit. The present review covers comprehensively up-to-date information on the synonyms, nutritional value, phyto-constituents and pharmacological profile of Kiwi fruit.

Keywords: *Actnidia deleciosa*, Kiwi fruit, Phyto-chemicals, Nutrients, Therapeutic uses.

INTRODUCTION

Functional foods are becoming a part of everyday life. Plant foods could be considered as functional foods since they are all rich in phytochemicals and nutrients. They are claimed to have medicinal effect on human health [1]. Green Kiwi is one of the most popular functional food. Scientifically, it is known as *Actnidia deliciosa* (Actinidiaceae) (taxonomical classification and botanical description of *Actinidia deliciosa* portrayed in table 1 and 2 respectively). It is also known as Chinese gooseberry. The genus name Actinidia refers the Greek word aktinos (rays), which refers to the styles of the female flower, which radisate from the center and resemble the spokes of a wheel. China is the native origin of Kiwi fruit, therefore, it is national fruit of China. Kiwi fruit got its name after the nickname for the locals and small flightless bird of the same name in the New Zealand. Kiwi fruit contains actinidin enzyme, which is considered as allergen. Furthermore, it is the unique source of various nutrients and phytochemicals for the development of medicines against various diseases. Healthful attributes of Kiwi due to presence of vitamins, folic acid, carbohydrates, minerals, amino acid, saponins, tannins, flavonoids and steroids [2, 3, 4] (table 4 and 6). It also contains kissper peptide, which is responsible for anti-inflammatory and anti-oxidant property. The prominent medicinal profile of Kiwi includes anti-hypertensive, anti-diabetic, anti-carcinogenic, anti-fungal, hepatoprotective, anti-asthma, anti-platelet, anti-nociceptive, anti-HIV etc (Pharmacological activities of *Actinidia deliciosa* displayed in table 5). Thus, Kiwi is cultivated for its nutritional benefits and useful medicinal properties.

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HISTORY

The origin of Kiwi fruit 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 Kiwi fruit. Kiwi is the name of New Zealand's national bird. In1962, it was exported to USA. For the past three decades Kiwi fruit has been increasingly available worldwide. In 1977, seedling was started in Korea and marketing of this Korean Kiwi fruit 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 antihypertensive were reported [5]. (Different varieties of Chinese *Actinidia deliciosa* described in table 7).

GEOGRAPHICAL DISTRIBUTION

It is mainly cultivated in areas with temperate climates and an adequately long summer season.

World scenario

It is indigenous to the mountainous regions of southwestern and central china. It is mainly cultivated in Central Europe (New Zealand, Chile, Turkey, Portugal, Italy, Greece, France and Japan), United States and China [6]. International Synonyms of *Actinidia deliciosa* is described in table 3.

CULTIVATION

Soil

- 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 favorable 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.

Climate

- Warm, humid and temperate regions with a rainfall of 50-70 inches are most favorable for growth of plant in southeast China. Winter temperature may reach -15°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 Kiwi fruit requires 220 day growing season.
- Degradation of vitamin C increases with increase in dry air temperature [7].

Storage and storage temperature

- Kiwi fruit should store at cooled to near 0 °C (32 °F) as soon as possible after harvest. Forced air cooling is preferred.
- The recommended storage conditions are 1 to 2 % O2 with 3 to 5% CO2 at 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 KIWI FRUIT

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.

Table 1. Taxonomical classification of *Actinidia deliciosa*

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

Table 2. Botanical Description of *Actinidia deliciosa*

Root	True Perennial
Fruit	Oval, ovoid or oblong is up to 2-2.5 inches long with russet brown skin covered short brown hairs.
Leaves	Alternate, Long petiole, deciduous, oval to nearly circular cordite at the base, 7.5-12.5 cm long
Flowers	Bisexual, Creamy-white to yellow colored flowers with a diameter up to 5 cm having 5 petals, sepals and numerous stamens
Seed	Soft, small and Dark purple or nearly black colored seeds

Table 3. International synonyms of *Actinidia deliciosa*

Sr.	Name	Language
1.	Kivi	Lithunian
2.	Trai ki wi, Trai duong dao	Vietnamese
3.	Kiwi	Swedish
4.	Kiwi	Romanian
5.	Quivi	Portuguese
6.	Kiwi	Polish
7.	Buah Kiwi	Indonesian
8.	Ciobhai	Irish
9.	Kiwi	French
10.	Kiwi frukt	Faroese
11.	Kiivihedelma	Finnish
12.	Kivio	Esperanto
13.	Kiwi	Dutch
14.	Chinesische Stachelbeere	German
15.	Kiwifugt	Danish
16.	Kiwi fruit	Hindi

Table 4. Phyto-constituents in different parts of *Actinidia deliciosa* [8, 9]

Sl.No	Phyto-constituents	Plant part used
1.	**Phenolic acids**- Vanillic acid, Hydroxyl cinnamic acid, Caffeic acid, Protocatechuic acid and Ferulic acid	Fruit, Root
2.	**Coumarins**- Umbelliferon, Fraxetin, Iso-scopoletin, Aesculetin,	Stem, Root, Fruit
3.	**Steroids**- Sitosterol	Root
4.	**Sesquiterpenoids**- Alpha-farnesene, Germacrene D, (E) - beta- ocimene.	Flower
5.	**Amino acids**- Histidine, Arginine, Tyrosine, Valine and Phenylalanine.	Fruit,
6.	**Carbohydrates**- Starch, Cellulose, Pectin, Sugars (Sucrose, fructose, glucose), Dietary fiber	Pulp, Peel
7.	**Vitamins**- Vitamin B1(Thiamine), Vitamin B2 (Riboflavin), Vitamin B3 (Niacin), Vitamin B6, Vitamin B9 (Folate), Vitamin C, Vitamin E, and Vitamin K.	Fruit
8.	**Minerals**- Magnesium (Mg), Phosphorous (P), Manganese (Mn), Potassium (K), Sodium (Na), Zinc (Zn)	Peel, Fruit
9.	**Protein**- Actinidin	Leaf, Seed, Fruit
10.	**Anthocyanins**- Carotenoids (Beta-carotene, Lutein)	Fruit
11.	**Flavonoids**- Quercetin, Kaempferol	Leaf, Seed
12.	**Organic acids**- Citric acid, Quinic acid, Maleic acid	Fruit
13.	**Enzyme**- Actinidin	Leaf, Fruit
14.	**Tannins**	Fruit

Table 5. Pharmacological activities of *Actinidia deliciosa* [10-26]

Sr.	Pharmacological activities	Plant parts	Extract
1.	Anti-HIV	Peel	Methanolic
2.	Cytotoxic	Fruit	Aqueous
3.	Anti-hypertensive	Pulp with peel	Ethanolic
4.	Anti-hypercholesterolemia	Pulp with peel	Aqueous or Ethanolic
5.	Anti-oxidant	Fruit	Ethanolic
6.	Anti-tumor	Fruit	Aqueous
7.	Anti-proliferative	Fruit	Phenolic
8.	Anti-carcinogenic	Fruit	Phenolic and flavonoid
9.	Anti-inflammatory	Fresh or raw fruit	Kissper peptide
10.	Anti-microbial	Fruit	Ethanolic
11.	Anti-spermatogenesis	Dried fruit	Hydroalcoholic
12.	Anti-constipation	Fruit	Lipid and kissper peptide mixture
13.	Anti-fungal	Fruit	21-kDa protein
14.	Hepatoprotective	Fruit	Crude
15.	Anti-asthma	Fruit	Fruit
16.	Ant-oxidative stress	Fruit	Fruit
17.	Anti-platelet	Fruit	Fruit
18.	Anti-nociceptive	Root	Ethanolic
19.	Fibrinolytic	Fruit	Methanolic
20.	Anti- thrombin	Fruit	Methanolic
21.	Anti-atherosclerotic	Fruit	Methanolic
22.	Dermatologic	Fruit	Polysaccharides

Table 6. Nutritional value of Kiwi fruit for edible portion [27]

Nutrients	Units	Value per 100 grams
Macro-components		
Water	g	147
Energy	kcal	61
Carbohydrate	g	14.66
Fat	g	0.52
Protein	g	1.14
Sugar	g	8.99
Fibre	g	3.0
Minerals		
Calcium	mg	34
Iron	mg	0.31
Magnesium	mg	17
Manganese	mg	0.098
Phosphorus	mg	34
Potassium	mg	312
Sodium	mg	3
Zinc	mg	0.2
Vitamins		
Thiamine B1	mg	0.027
Riboflavin B2	mg	0.025
Niacin B3	mg	0.341
Vitamin B6	mg	0.63
Folate B9	µg	25
Vitamin C	mg	92.7
Vitamin E	mg	1.5
Vitamin K	µg	40.3
Amino acids		

Aspartic acid	g	14.5
Glutamic acid	g	13.1
Serine	g	4.1
Glycine	g	8.2
Histidine	g	0.7
Arginine	g	3.9
Threonine	g	8.5
Alanine	g	5.4
Tyrosine	g	10.4
Proline	g	3.4
Valine	g	7.2
Methionine	g	0.7
Cysteine	g	0.6
Leucine	g	4.9
Phenylalanine	g	3.2
Cysine	g	2.8
Tryptophan	g	6.2

Table 7. Different varieties of Chinese *Actinidia deliciosa* [27]

Sr.	Varieties	Properties
1.	Zhong Hua (Chinese gooseberry)	Round to oval, or oblate, weight: 6.5 to 80 g. 3 sub varieties are: Yellow flesh, Green flesh, Yellow- green and Green-yellow.
2.	Jing Li (Northern pear gooseberry)	Elevated oval with green flesh. Leaves usually hairless.
3.	Ruan Zao (Soft date gooseberry)	Small, with green flush and quite sweet. Good for jam and usually grow in hills.
4.	Mao Hua	Tight or loose haired, green and sweet flesh. Leaves are elongated oval, broad and thick.

CONCLUSION

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 food 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 originated from China and national fruit of China. 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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