Medicinal, Nutritional and Health Benefits, Pharmacological Properties of KIWI – A Review

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Abstract:

Global health and treatment approaches aim to combine complementary and alternative medicine with evidence-based medicine to better comprehend the human body's metabolic processes. The kiwi fruit frequently referred to as the "Chinese gooseberry" belongs to the Actinidiaceae family and is classified as Actinidia genus and species deliciosa. Kiwi fruit has seen a significant increase in demand recently because of its high vitamin C content. Kiwi fruit is also a great source of antioxidants, carotenoids, iron, and dietary fiber. These could help regulate blood sugar, reduce blood pressure, promote wound healing, and enhance intestinal health. Antioxidants such as vitamin C, choline, lutein, and zeaxanthin help the body eliminate free radicals and may shield the body from a number of illnesses and inflammations. Contributing significantly to the flavonoid and phenolic contents in kiwi fruit, it is a primary source of phytochemicals such as caffeic acid, gallic acid, syringic acid, salicylic acid, ferulic acid, and protocatechuic acid. Numerous pharmacological qualities, such as anti-diabetic, anti-tumor, anti-inflammatory, anti-ulcer, antioxidant activity, hypoglycemia, hypolipidemic, and many more, have been linked to kiwi fruit and its constituents. In addition to these, kiwi fruit is traditionally used to treat microbiological infections, rheumatoid arthritis, hepatitis, edema, and renal issues. The fiber in kiwi fruit promotes the fruit's ability to retain water, which helps to shorten transit times and preserves the person's gastrointestinal health. Studies are also being conducted on the homeostatic balance, weight maintenance, and insulin and glucose balance in relation to kiwi fruit consumption.

Keywords: Actinidia deliciosa, Chinese gooseberry, Hypoglycemia, Kiwi, Cancer

Introduction:

Anti-microbial agents and anti-oxidants found in fruits can be included in diets to prevent diseases caused by pathogenic organisms. Our bodies require a lot of nutrients to carry out these reactions and function properly, and fruits like apples, pomegranates, guavas, and oranges provide us with these nutrients. The edible berries of numerous species of woody wines and nutrient-dense fruit are known as kiwi fruit or Chinese gooseberries. The genus Actinidia and family Actinidiaceae are home to kiwi fruit. Originating in the Yangtze Valley of China, kiwi fruit was first grown as a fruit tree in New Zealand during the 1900s. The majority of its production occurs in temperate regions that lie between 25- and 45-degrees latitude. At the moment, kiwi fruit has several proteinases and vitamins. As a result, kiwi fruit is becoming more and more popular due to its nutritious qualities, delightfully refreshing taste, health advantages, and economic feasibility. The pharmacological activities are displayed in every section of the kiwi fruit. Flesh, peel, and seed offer some guidelines to enhance financial gains. The nutraceutical, pharmaceutical, cosmetic, detergent, and textile industries have created a variety of compounds derived from kiwifruits (Supplementary materials). In the fruit industry, more fruit pulp is consumed, which leads to more fruit skin or seed kernel waste being produced. In our daily lives, we directly ingested the gooseberry's mesocarp and endocarp, discarding the exocarp, or peel. However, because the peel and the edible component are so closely related, the peel's high phenol, terpenoids, and tannin content gives it numerous pharmacological actions. The production of kiwifruit is processed into a range of goods, such as jams, juice concentrates, and natural or clarified fruit juices.

Botanical aspects:

Taxonomical Classification:

Botanical Name: Actinidia deliciosa

Synonyms: Chinese gooseberries, woody vine, green kiwi

Table 1: Taxonomical classification of kiwi

Classification	Name
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Magnoliidae
Order	Ericales
Superorder	Asteranae
Family	Actinidiaceae
Genus	Actinidia
Order	Deliciosa

Morphology:

Table 2: Morphology of Actinidia deliciosa

Parts	Description
Fruit shape	Long cylindrical or elongated
Fruit weight	30-200 gm
Fruit skin color	Brown
Skin hair	Dense, yellow brown, coarse hairs
Flesh color	Green
Leaves	Long petiole, alternate, deciduous, heart shape at bottom (8-12 cm length)
Flowers	Aromatic, dioecious, 4-6 petiole, white initially changing to yellow
Roots	Fleshy and branched

Flower

Fruit

Leaves

Kiwi on veins

Chemical constituents:

Protocatechuic acid: Anti-bacterial activity, anti-oxidant, anti-inflammatory activity, anti-hyperglycemic activity and neuroprotective

Caffeic acid: Antioxidant and anti-inflammatory activity

Folate: it prevents neural tube defects (nts) in baby

Vitamin C: stimulates the body's immune response and antioxidant

Vitamin E: skin disorders

Gallic Acid: anti-microbial and anti-obesity

Cryptoxanthin: antioxidant

Lutein: increases serotonin

And other minor are Saponins, Tannins, Flavonoids, carotene, tocopherol, actinidian, carbohydrates etc.…

Table 3: Nutritional contents

Nutrient	Amount in 1 kiwi (69 g)	Daily adult requirement
Energy (calories)	42.1	1,600-3000
Carbohydrates (g)	10.1 including 6.2g of sugar	130
Fiber (g)	2.1	22.4-33.6
Calcium (mg)	23.5	1,000-1,300
Magnesium (mg)	11.7	310-420
Phosphorus (mg)	23.5	700-1250
Potassium (mg)	215	4700
Copper (mcg)	90	890-900
Vitamin C (mg)	64	65-90
Folate (mcg)	17.2	400
Beta carotene (mcg)	35.9	No data
Lutein zeaxanthin (mcg)	84.2	No data
Vitamin E (mg)	1.0	15
Vitamin K (mcg)	27.8	75-120

Kiwi also contains small amounts of iron, vitamin A and vitamins other than folate

Pharmacological activity:

Numerous research studies have been conducted to examine the pharmacological profile and potential health benefits of kiwis. Many biological effects have been noted, such as anti-oxidant, anti-diabetic, anti-inflammatory, and anti-hypertensive properties; they have also been shown to have anti-thrombin, anti-asthmatic, hepatoprotective, anti-platelet, anti-nociceptive, anti-microbial, anti-carcinogenic, anti-fungal, antiviral, and anti-tumor properties. Many health advantages are bestowed by its diverse pharmacological profile. It also protects against cancer, heart problems, and HIV/AIDS. It makes a major contribution to the improvement of metabolic anomalies, including hypertension, hemostatic disease, vascular inflammation, dyslipidemia, and low-density lipoprotein.

- **Antidiabetic Activity:**

According to Shirosaki et al., mice's postprandial blood glucose levels are decreased by kiwifruit leaf extract. The leaf of the kiwifruit guards against metabolic diseases like diabetes. Using ten volumes of MeOH, fresh kiwifruitleaves (1000 mg/kg) were gathered for a week. To create a crude extract in the form of a green powder,

kiwifruit leaf extract was condensed under low pressure. The study found that kiwifruit leaf extract protects mice against diabetes. Soren et al. used albino Wistar male rats with diabetes to study the anti-diabetic, methanolic effect of Actinidia deliciosa; kiwifruit extract was given at doses of 500 mg and 1000 mg/kg p.o in 1 ml of an aqueous solution for seven days. This investigation demonstrated the antidiabetic properties of kiwifruit methanolic extract. A one-week investigation on male Wistar rats (30) was conducted, according to Suksumboon et al. Both the 500 and 1000 mg/kg doses of kiwifruit extract were found to significantly lower blood glucose levels when compared to the diabetic control group[25,33].

- **Gastro-protective Activity:**

Rats exhibited gastro-protective effect against stomach and duodenal damage induced by aspirin, according to Hewitt et al.'s investigation into the gastro-protective activity of Actinidia deliciosa. A 20% (75gm) pureed fresh kiwifruit diet contributed to the effects of green kiwifruit diets on genes associated with gastroprotection. The researchers noticed that when diets including green and gold kiwi fruit were given, there was an increase in the expression of genes related to inflammation, NOS2 and TNF alpha. Additionally, it demonstrated a variety of opposing effects on genes associated with gastroprotective and inflammatory properties[13,35].

- **Antidepressant Activity:**

Muzzammil et al. claim that kiwifruit juice has an antidepressant effect on rats in a study. Effective treatment for depression was achieved with a 10 ml/kg dosage of kiwifruit extract. Depression was on the decline. A tail suspension test revealed that the kiwifruit exhibited strong antidepressant properties. Fresh kiwifruit juice exhibits similar antidepressant effectiveness without any adverse effects, according to biochemical testing[34].

- **Wound Healing Activity:**

A bandage composed of fresh kiwifruit slices has the capacity to heal acute burn wounds, as shown by two recent investigations conducted on rats. Rats with kiwifruit dressings had much smaller wound surface regions than the control group, and the kiwifruit-treated group's dry scars separated faster. Furthermore, kiwifruit had strong anti-bacterial and angiogenic properties when compared to a control group and a group of rats treated with silver sulfadiazine cream. The investigators noted that among the rodents given kiwifruit, there were no positive cultures for staphylococcus, pseudomonas, or streptococcus. Regarding kiwifruit's impact on inflammation and blood vessel count, the findings from the two investigations remained equivocal. Because of its advantageous proteolytic effect, actinidin and other degenerative enzymes found in kiwifruit have been suggested as a possible cause of improved wound debridement. In addition, it is necessary to characterize the effect of kiwifruit dressings on wound healing in order to ascertain which kinds of wounds heal more quickly and whether various techniques for making kiwifruit- based dressings work well. It is necessary to determine the elements of the kiwifruit that produced the beneficial effects as well as the mechanism underlying the improved healing[36].

- **Anti-oxidant Activity:**

Kang et al. examined the protective effects of kiwifruit extract against CCl4-induced liver injury in mice. The BALB/c mice used in this investigation were six weeks old. The pulp of kiwifruits was recovered in 80% MeOH and utilized at a dose of 100 mg/kg/day in animal treatment trials. According to Kang et al., using kiwifruit extract provides preventive benefits. It showed hepatotoxicity in mice given CCl4 and antioxidant action in rats[30,31,32].

- **Anti-inflammatory, Analgesic, and CNS Activity:**

Kumar et al. addressed the analgesic, anti-inflammatory, and central nervous system effects of kiwifruit. The study looks at how an ethanolic extract from kiwis affects the above listed activities. The experiment's treatment plan was for 500 mg/kg of kiwifruit. It was discovered that the ethanolic extract exhibited strong analgesic, anti-inflammatory, and central nervous system effects. These effects may be caused by the phenolic components and flavonoid concentrations found in the ethanolic kiwifruit extract[24,32].

- **Cancer:**

An anti-mutagenic ingredient found in Actinidia deliciosa aids in preventing gene alterations that may result in cancer. Glutathione may be the cause of the decline. When food is smoked or grilled, carcinogenic nitrates are created. Consuming nitrates causes a process called nitrosation, which produces free radical nitrosamines. These nitrosamines can cause cancer to grow in the stomach and other organs. Actinidia deliciosa contains lutein, a phytochemical[5,29,37].

- **Bone health:**

Kiwifruit is high in folate, magnesium, and vitamin E, all of which have health advantages ranging from bone building to heart health. Vitamin K may play a role in bone mass formation by boosting osteotropic activity in the bone[26,27].

- **Hair health:**

Fruit contains elements such as zinc, magnesium, and phosphorus, which promote hair development and blood circulation. It also contains vitamins C and E, which aid in hair growth. Kiwi seed oil includes omega-3 fatty acids,which help to keep hair moisturized (Billows et al.,2022). Copper, which is abundant in kiwis, keeps hair from becoming grey too soon and helps it maintain its original colour. The iron in fruit nourishes the hair and encouragehealthy blood flow to the scalp. It strengthens the hair from the roots up as a consequence[13,14].

Health benefits:

Recent research by nutritionists and food experts has confirmed that consuming fruits and vegetables that has been associated with the prevention of lung and prostate cancer. on a daily basis lowers the chance of developing certain illnesses, including cancer, heart disease, and stroke. These advantageous benefits are attributed to antioxidants (polyphenols, ascorbic acid, carotenoids, and tocopherols) present in fruits and vegetables. By attaching to metal ions, lowering hydrogen peroxide, quenching superoxide and singlet oxygen, and scavenging radicals, these antioxidants reduce disease risk. Consuming kiwifruit has been associated with a slight risk reduction for certain malignancies and cardiovascular illnesses. Because of its cytotoxic and antioxidant qualities, kiwifruit has also been used to treat many malignancies, primarily liver, lung, and digestive system cancers[5,19].

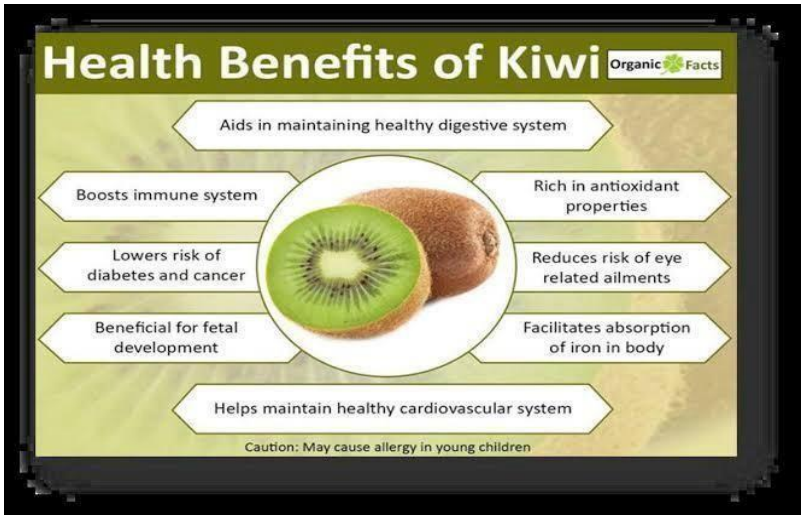


Table 4: Health benefits

Health benefit	Key findings	References
Prevent cancer	• The biochemical composition of kiwifruit like carotenoids, vitamins, antioxidants, and fibers are effective in the prevention of various types of cancers • It works as a cytotoxic agent against malignant cancerous cells instead of affecting the healthy body cells • Being a good source of fiber, it helps in decreasing the risk of colon cancer	Motohashi et al. (2002)
Maintains skin health	• It is a potent source of vitamin C which being an antioxidant, helps in prevent4ing damage caused by UV radiations, pollution, smoke and thus improves overall s4kin quality	Tyagi et al. (2015)

	• It 4is rich in vitamin K that is essential for healthy and glowing skin	
Maintains good digestive health	• The fruit has been known to maintain good digestive health as it possesses laxative properties which helps in treating constipation • It contains actinidin (proteolytic enzyme) which influences the gastric and intestinal digestion of proteins in a positive manner	Stonehouse et al. (2013)
Protects against oxidative DNA damage	• The wide range of antioxidants (vitamins, zeaxanthin, lutein, polyphenols etc.) present in kiwi contributes to its high antioxidant potential • It plays a vital role in preventing postprandial oxidative damage owing to its high antioxidant capacity • Research studies have revealed that the consumption of kiwi juice has been linked with a decrease in the oxidative damage in DNA	Collins et al. (2001), Prior (2007), Stonehouse et al. (2013)
Diabetes	• It is a suitable choice for the patients suffering from type 2 diabetes mellitus as the whole fruit is known to have a low glycemic impact	Mishra et al. (2017), Wilson et al. (2018)
Improves immunity	• It might improve innate and adaptive immune function of human blood cells • Research studies have revealed that supplementation of kiwi fruit extract in mice resulted in an increase in the rate of process of phagocytosis and immunoglobulins levels (IgA, IgG and IgM)	Ma et al. (2006), Skinner et al. (2011), Hunter et al. (2011)
Help to treat iron deficiency	• Kiwi helps in overcoming iron deficiency • It contains high amount of pigments like carotenoids, ascorbic acid and citric acid which helps in improving the iron status of an individual	Beck et al. (2011), Diaz et al. (2017)
Improves cardiovascular health	• Being a potent source of polyphenols and antioxidants, kiwi is proved to be effective in the maintenance of heart health • It helps to regulate blood pressure (B.P.) and platelet aggregation in smokers. It has been known to cause reduction in the systolic and diastolic B.P. by 10- and 9-	Karlsen et al. (2013), Tyagi et al. (2015)

	mm Hg respectively	
Bone health	• It exhibits protective effects with daidzein on bone metabolism ovariectomized rats • It helps to prevent ovariectomy induced decline in BMD (bone mineral density)	Katsumata et al. (2015)
Pregnant women	• Kiwi is a good source of folic acid and thus advantageous for pregnant women as it aids in foetal development	Tyagi et al. (2015)

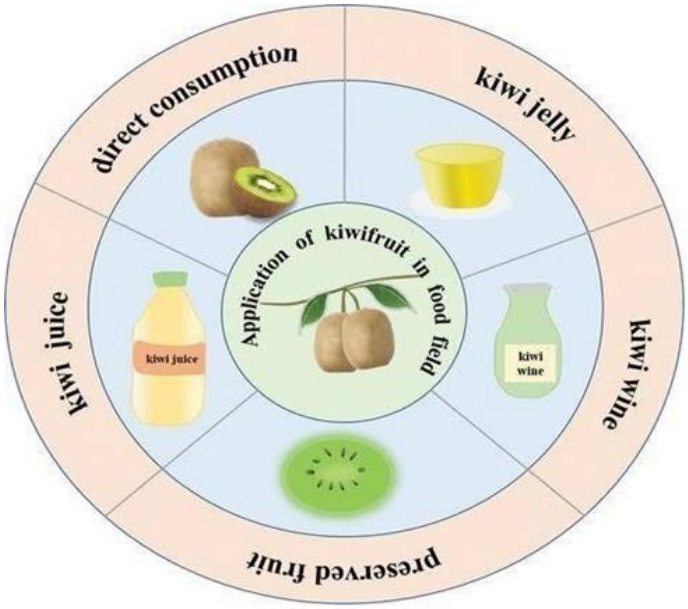
Table 5: Traditional uses of different parts of kiwi

Plant part	Traditional utilization	References
Root	• The root of kiwi plant possesses anti- hepatotoxic, anti-pyorrheal and gingival inflammation • Root is utilized for treating hepatitis, edema, gastric and breast carcinoma	Shastri et al. (2012), Chawla et al. (2016)
Stem	• Stem and root have sedative effect and are used as diuretic and febrifuge • It is utilized for treating stones of urinary tract, liver and esophageal cancer as well as rheumatoid arthralgia	Ferguson and Bollard (1990), Shastri et al. (2012)
Seed	• The seeds of kiwi exhibit blood thinning property due to the presence of vitamin E and omega-3 fatty acids	Chawla et al. (2016)
Peel	• The peel extract exhibits anti-microbial, anti-viral properties • Due to the presence of high phenolic content, the peel extract has been known to possess anti-oxidant and anti-cancer properties	Motohashi et al. (2001), Zawawy (2015), Chawla et al. (2016), Alim et al. (2019)

Table 6: Commercialization of kiwi fruit

Kiwi-based product	Brand or company
AloFrut Kiwi Aloevera Juice	AloFrut
Monin kiwi syrup	Monin
Bella nuts dehydrated kiwi	Bellanuts
Kiwi jam	Orchard Lane
Ck Paris kiwi fruit scrub	CK Paris
Green apple and kiwi face wash	Anherb
Kiwifruit chocolates	Aotea
Kiwi crush	Mapro, Mala's
Kiwi fruit lip balm	Khadi natural
Kiwi soap	Vaadi herbal
Kiwi freshness gel face facial	Lakme
Purple kiwi seeds milk taste	Wintefei

Applications of kiwi fruits:



Conclusion:

In conclusion, the nutrient-dense nature and health advantages of kiwi fruit are making it increasingly popular around the globe. It exhibits a wide range of pharmacological effects because of its significant chemical contents, which include vitamins, phenolic compounds, proteolytic enzymes, amino acids, etc. Regular kiwi consumption hasbeen demonstrated to lower the incidence of several diseases. As a result, the demand for Kiwi fruit rises daily. Thebioactive and nutritional diversity of the kiwi fruit offers numerous health benefits. Because of this, kiwi fruit can beused in many different contexts, such as being a helpful source of natural materials for making products. We can expect further ways that kiwifruit will improve our health in the future as the potential health advantages of consumingthem are better studied.

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