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**Review Article**

# The Phytochemical And Pharmacological Review Article Of Fig Tree (Ficus Carica)

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## ABSTRACT

Ficus carica, also known as the fig tree, is a deciduous or evergreen tree native to the Middle East and western Asia. It is cultivated worldwide for its edible fruit, known as the fig. The fig is a false fruit, known as a syconium, with tiny flowers inside. The most common fig varieties have a sweet, juicy flesh and a soft, edible skin. The fig tree has a long history of cultivation and is associated with fertility, rebirth, and abundance.The fig tree has a broad, palmate leaf size, with three to five lobes. The fig consists of a hollow fleshy receptacle lined with numerous small flowers, which are actually modified inflorescences. The seeds of Ficus carica are small and typically measure around 2-4 mm in size. The fig fruit is medium to large in size, ranging from 3-5 cm in length.Propagation of Ficus carica can be done through several methods, including cuttings, preparation planting, rooting, and transplanting.

## INTRODUCTION

The Ficus carica, commonly known as the fig tree, is a species of flowering plant in the mulberry family, Moraceae. It is native to the Middle East and western Asia, but is now cultivated worldwide for its edible fruit.[1] The fig tree is a deciduous or evergreen tree, growing up to 10 meters in height. It has a smooth gray bark and large, lobed leaves that are alternate, simple, and deeply dissected. The leaves are often used in traditional medicine for their various health benefits. One of the most distinctive features of the fig tree is its unique fruit, known as the fig .The fig is actually a false fruit, known as a syconium, which is an inverted inflorescence with tiny flowers on the inside. The most common fig varieties have a sweet, juicy flesh and a soft, edible skin.[2] Ficus carica has a long history of cultivation and has been grown for its fruit since ancient times. It is believed to have been domesticated over 5,000 years ago, and is mentioned in many ancient texts and scriptures. The fig tree holds cultural significance in many regions and is often associated with fertility, rebirth, and abundance. [3]

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- **TAXONOMY**

| | |
|---|---|
| Kingdom | Plantae |
| Division | Magnoliophyta (Flowering Plant) |
| Class: | Magnoliopsida (Dicotyledonous) |
| Order: | Urticales |
| Family | Moraceae Family |
| Genus | Ficus |
| Species | Ficus carica (Linn) [4] |

- **SYNONYMS**

Common fig, Edible fig, Fig tree. [5]

- **REGIONAL NAME**

| | |
|---|---|
| English | Fig |
| Spanish | Higuera |
| French | Figuier |
| German | Feigenbaum |
| Italian | Fico |
| Hindi | Anjeer (अंजीर) |
| Portuguese | Figueira |
| Chinese | 無花果 (Wú huā guǒ) [6] |

- **DESCRIPTION:-**

**1. Leaf**

Size in Ficus carica generally ranges from 12 to 25 cm in length, but some varieties may have larger or smaller leaves. The leaves are typically broad and palmate with three to five lobes, giving them a hand-like appearance. [7]

**2. Flowers**

The fig consists of a hollow fleshy receptacle, lined internally with numerous small flowers. These flowers are not easily visible, as they are encased within the fig. The small flowers are actually modified inflorescences, with both male and female flowers present within the same syconium. [7]

**3. Seed**

The seeds of Ficus Carica, are small and typically measure around 2-4 mm in size. They have an elongated, ovoid or kidney-like shape, with one end being pointed and the other end slightly rounded or blunt. The color of the seeds can vary depending on the specific variety. They are commonly light to dark brown in colour. [7]

Fruits are generally medium to large in size, ranging from 3-5 cm in length. They have a unique pear or bell-shaped structure and a soft, thin skin that is often purple, brown, green, or yellow depending on the variety and ripeness. The skin is delicate and prone to splitting when fully ripe. The fig fruit's soft, juicy flesh, varying in color from pale yellow to deep purple, is surrounded by edible seeds, providing a slight crunch. [7]

- **PROPAGATION:-**

The Propagation of Ficus Carica can be done by several methods which are given below.

1. **Cuttings:**

Fig tree cuttings are taken during the growing season, usually in late spring or early summer. Cuttings should be taken from a healthy, woody branch, approximately 15-20 cm long. Both softwood and semi-hardwood cuttings can be propagated.

2. **Preparation:**

After taking the cuttings, it's recommended to cut the leaves in half to reduce water loss. They can also be treated with hormones to promote rooting.

3. **Planting:**

Cuttings are planted in pots with a suitable rooting substrate. The substrate should be kept moist but not waterlogged.

4. **Rooting:**

Fig tree cuttings typically root within a few weeks. During this time, it's important to maintain a warm and humid environment to encourage rooting.

5. **Transplanting:**

Once the cuttings have rooted, they can be transplanted to their permanent locations in the garden or into larger pots.

**TRADITIONAL USES:-**

Ficus carica has a long history of utilization in traditional medicine to address various health issues. The bark, fruit, leaves, roots, and latex are employed for their medicinal properties in diverse

forms. Further, it is often utilized in conjunction with another medicinal plant, Laurus nobilis Linn (Lauraceae), commonly known as Paathri, along with natural foods like honey and milk.[8] Moreover, in Mediterranean regions, the fig is so commonly consumed, both fresh and dried, that it has earned the moniker "the poor man's food." [9] In Unani medicine, Ficus carica is employed as a mild laxative, expectorant, diuretic, and in the treatment of liver and spleen diseases as a deobstruent and anti-inflammatory agent. In ethnomedicine, the fruits are utilized in addressing leprosy and nose bleeding, and are also considered antipyretic, aphrodisiac, lithontriptic, hair-nutritive, emollient, demulcent, laxative, and in the treatment of various inflammations, paralysis, liver diseases, chest pain, and piles. The roots serve as a tonic in treating leucoderma and ringworm infection. The latex is used as an expectorant, diuretic, anthelmintic, and to combat anemia. Additionally, the leaves are utilized as antidiabetic, vermifuge, and in addressing contact dermatitis in humans and phototoxicity in animals. Moreover, the seeds are used for edible oil and as a lubricant. Both traditional and contemporary uses of Ficus carica, including Ayurvedic, Unani, and various ethnobotanical survey reports, are documented. [10]

**PHYTOCHEMISTRY :-**

Phytochemical analysis of Ficus carica has resulted in the discovery of various compounds, including phytosterols, anthocyanins, amino acids, organic acids, fatty acids, phenolic components, hydrocarbons, aliphatic alcohols, volatile components, and other secondary metabolites across its different parts. These phytochemicals are predominantly present in the latex, with significant presence also in the leaves, fruit, and root. Certain phytoconstituents of Ficus carica find application in the manufacture of sunscreen and coloring agents. These phytoconstituents exhibit noteworthy pharmacological properties, including antioxidant, anticancer, cytotoxic, anti-inflammatory, and hypolipidemic activities. [11]

**1. ORGANIC ACID:-**

The organic acid profile of fig leaves consists of six organic acids: oxalic, citric, malic, quinic, shikimic, and fumaric acids. In the pulps and peels, quinic acid was not found. It was Shiraishi et al. (1996) who first reported the presence of quinic and shikimic acids in Ficus carica. The quantity of quinic acid is notably high at 10,502 mg/kg of leaf extract, followed by malic, citric, oxalic, shikimic, and fumaric acids at 8704, 2280, 155, 142, and 23 mg/kg of extract, respectively. [12]

**2. AMINO ACID:-**

The amino acid composition of Ficus carica latex was determined using high-performance liquid chromatography coupled to ultraviolet-visible spectroscopy (HPLC/UV-vis). The analysis identified 13 compounds, consisting of five essential amino acids (leucine, tryptophan, phenylalanine, lysine, and histidine) and eight non-essential amino acids (asparagine, alanine, glutamine, serine, glycine, ornithine, tyrosine, and cysteine). Among these, tryptophan, cysteine, and tyrosine were found in higher quantities compared to the other amino acids. [13]

**3. FATTY ACID:-**

The fatty acid composition of Ficus carica latex was analyzed using gas chromatography ion trap mass spectrometry (GC-ITMS). The analysis revealed the presence of 14 major detectable fatty acids, namely myristic, pentadecylic, palmitic, margaric, cis-10-heptadecenoic, stearic, oleic, elaidic, linoleic, arachidic, heneicosylic, behenic, tricosylic, and lignoceric. Their respective quantities were reported as 0.56, 1.35, 28.94, 0.66, 0.10, 8.62, 5.54, 0.35, 14.59, 91.29, 0.77, 26.43, 1.25, and 1.90 mg/kg of latex tissue. [13] The main fatty acids present in the latex of Ficus carica are palmitic, arachidic, and behenic acids, constituting 21.4%, 44.1%, and 13.1% of the total fatty acid content, respectively. The latex

primarily consists of saturated fatty acids, monounsaturated fatty acids, and polyunsaturated fatty acids, with quantities of 161.77, 5.89, and 14.59 mg/kg of latex, as reported by Oliveira et al. (2010). Additionally, gas chromatography was utilized to identify these components in dried fig fruit. In dried fig fruit, linolenic acid was found to be the predominant fatty acid at 53.1%, followed by linoleic acid at 21.1%, palmitic acid at 13.8%, and oleic acid at 9.8%. [14]

**4. PHYTOSTEROLS :-**

Phytosterols, which resemble cholesterol, are present in the majority of plant-based foods, particularly in vegetable oils where they are most concentrated. While they are only absorbed in minimal quantities, they play a critical role in inhibiting the absorption of intestinal cholesterol, including the recirculation of endogenous biliary cholesterol, thus contributing significantly to the elimination of cholesterol from the body.[15] These compounds play essential roles in various cellular processes, including the regulation of membrane fluidity, adaptation of membranes to temperature, as well as involvement in cellular differentiation and proliferation. The presence of seven phytosterols in the Ficus carica latex extract was identified using gas chromatography ion trap mass spectrometry (GC-ITMS).[16] The quantification was accomplished using high-performance liquid chromatography coupled to diode array detection (HPLC-DAD). The quantities of betulol, lupeol, lanosterol, lupeol acetate, β-amyrin, β-sitosterol, and α-amyrin phytosterols were found to be 327, 2827, 2634, 1989, 1197, 10564, and 76 mg/kg of plant latex, respectively. Notably, β-sitosterol was the most abundant compound, constituting approximately 54% of the total, while α-amyrin was the least abundant, making up approximately 0.4% of the total. [17,18]

**5. VOLATILE COMPOUNDS :-**

A comprehensive analysis utilizing headspace solid-phase microextraction/gas chromatography-ion trap mass spectrometry (HS-PME/GCIT-MS) has revealed the presence of 31 volatile compounds in the latex of Ficus carica. These encompass aldehydes (pentanal, hexanal, heptanal, benzaldehyde, and octanal); alcohols (1-butanol-3-methyl, 1-butanol-2-methyl, 1-pentanol, 1-hexanol, 1-heptanol, phenylethyl alcohol, and phenylpropyl alcohol); ketone (6-methyl-5-hepten-2-one); monoterpenes (α-thujene, α-pinene, β-pinene, limonene, terpinolene, eucalyptol, cis-linalool oxide, linalool, and epoxylinalool); and sesquiterpenes (α-guaiene, α-bourbonene, β-caryophyllene, trans-α-bergamotene, α-caryophyllene, β-muurolene, germacrene D, cadinene, and α-calacorene). [18]

**6. ANTHOCYANIN :-**

Solomon and colleagues (2006) made a groundbreaking discovery by identifying a novel anthocyanin pigment in figs. Through the application of proton and carbon NMR spectroscopy, they successfully revealed the structure of this new anthocyanin, which was named cyanidin-3-rhamnoglucoside and designated as C3R. It is widely acknowledged that secondary metabolites originating from plants are renowned for their medicinal properties and beneficial effects on health. Building on this, Solomon et al. (2010) delved into investigating the antioxidant capabilities of C3R. Their findings indicated that this compound effectively hinders lipid peroxidation by generating peroxy radicals and malondialdehyde in a dose-dependent manner. Furthermore, in addition to its ability to scavenge reactive oxygen species, C3R exhibited a potent chelating activity towards the Fe2+ ion. The demonstrated strong antioxidant potential and multiple modes of action of purified C3R suggest potential health benefits through the consumption of fresh fig fruits. [19]

**7. PHENOLIC COMPOUND :-**

Phenolic compounds are widely present in fruits, playing specific roles that are crucial for sensory attributes such as flavor and color. Additionally, these compounds have garnered attention from both scientists and consumers due to their health-promoting properties, particularly their antioxidant effects.[12] The phenolic profile of fig leaves consists of seven key phenolic compounds, namely 3-CQA (3-O-caffeoylquinic acid), 5-CQA (5-O-caffeoylquinic acid), Q-3-Glu (quercetin 3-O-glucoside), Q-3-rut (quercetin 3-O-rutinoside), ferulic acid, psoralen, and bergapten. [20]

- **PHARMACOLOGY :-**

**1. ANTIOXIDANT ACTIVITY :-**

The Ficus carica plant contains numerous phenolic compounds that serve various physiological roles in plants. Some of these compounds also have favorable effects on human health, as they can act as antioxidants through different mechanisms, such as being reducing agents, hydrogen donators, free radical scavengers, and singlet oxygen quenchers, among others. In a study focusing on fig fruits of the Ficus carica plant, six commercial fig varieties with different colors (black, red, yellow, and green) were analyzed for total polyphenols, total flavonoids, antioxidant capacity, and anthocyanin profile. The antioxidant properties were assessed using the ferric reducing antioxidant method. The findings revealed that the fruits exhibited the highest levels of polyphenols, flavonoids, and anthocyanins, and they demonstrated the highest antioxidant capacity. [21,22]

**2. HEPATOPROTECTIVE ACTIVITY :-**

The hepatoprotective activity of the petroleum ether extract from Ficus carica leaves was assessed on rats that were orally administered 50 mg/kg of rifampicin. The study demonstrated a notable reversal of the biochemical, histological, and functional changes induced by rifampicin in the rats, suggesting potential hepatoprotective activity. [23,24]

**3. ANTISPASMODIC AND ANTIPLATELET :-**

The aqueous-ethanolic extract of Ficus carica was studied for its antispasmodic effect on rabbits and its antiplatelet effect using a human platelet ex-vivo model. F. carica tested positive for alkaloids, flavonoids, coumarins, saponins, sterols, and terpenes. When tested on isolated rabbit jejunum, F. carica (0.1–3.0 mg/mL) caused relaxation of impulsive and low K+-(25 mM) induced contraction, with insignificant effects on high K+ (80 mM), similar to those caused by cromakalim. Pretreatment of the tissue with glibenclamide resulted in a rightward shift in the curves of low K+ but did not cause high potassium ion, while verapamil equally repressed the concentration of potassium ion at both concentrations. Furthermore, F. carica (at concentrations of 0.6 and 0.12 mg/mL) suppressed adenosine-5-diphosphate and adrenaline-induced human platelet aggregation. This study demonstrated spasmolytic activity in the ripe dried fruit of Ficus carica, likely mediated through the activation of potassium ion ATP channels, along with antiplatelet activity. These findings provide a solid pharmacological basis for the medicinal use of F. carica in gut motility and inflammatory disorders. [25]

**4. HYPOGLYCEMIC PROPERTY :-**

The leaf extract of Ficus carica caused a pronounced hypoglycemic effect when administered orally or intraperitoneally in streptozotocin-induced diabetic rats. Treated diabetic rats showed prevention of weight loss, and there was a significant alteration in plasma insulin levels, reflecting a noteworthy impact on the survival index. These results clearly indicate the hypoglycemic activity of the aqueous extract of F. carica. [26]

**5. HYPOLIPIDEMIC PROPERTY :-**

The leaf extract of Ficus carica has the potential to serve as a beneficial supplement for regulating triglyceride (TG) and total cholesterol (TC) secretion in poultry liver 45. In an experiment involving eight-week-old roosters with high abdominal fat, their livers were extracted, sliced, and cultured with increasing concentrations of leaf extract, insulin, or a combination of both.It was observed that insulin significantly increased TG secretion (0.190 ± 0.013 mmol/L), TG content (0.523 ± 0.093 mmol/L), and TC secretion (1.727 ± 0.412 mmol/L) beyond the basal level ($P$ < 0.001). However, when the leaf extract was added, these effects were dramatically reduced to the basal level in a concentration-dependent manner ($P$ < 0.001). [27]

**6. ANTIBACTERIAL AND ANTI-FUNGAL PROPERTY :-**

The methanol extract of Ficus carica (with minimum inhibitory concentrations, MICs, ranging from 0.156 to 5 mg/mL, and minimum bactericidal concentrations, MBCs, ranging from 0.313 to 5 mg/mL) exhibited robust antibacterial activity against oral bacteria. Furthermore, when combined with ampicillin or gentamicin, the methanol extract showed synergistic effects against oral bacteria, suggesting that figs could function as a natural antibacterial agent 19. In a separate study, hexane, chloroform, ethyl acetate, and methanol extracts of F. carica latex were examined for their antimicrobial properties in vitro against five bacterial species and seven strains of fungi using the disc-diffusion method. The minimal inhibition concentration (MIC) of the methanol fraction resulted in complete inhibition against Candida albicans (100%) at a concentration of 500 $\mu$g/mL, and it had a detrimental effect against Cryptococcus neoformans. Additionally, the methanolic extract (75%) strongly inhibited Microsporum canis, whereas the ethyl acetate extract showed strong inhibition at a concentration of 750 $\mu$g/mL. [28]

**7. ANTIPYRETIC PROPERTY :-**

The ethanol extract of Ficus carica, administered at doses of 100, 200, and 300 mg/kg, demonstrated a noteworthy dose-dependent decrease in normal body temperature and in yeast-induced fever. The duration of this effect lasted up to five hours after drug administration as compared to the standard antipyretic agent, paracetamol (150 mg/kg body weight, orally). [29]

**8. ANTITUBERCULOSIS PROPERTY :-**

The anti-tuberculosis activity of the 80% methanol extract derived from the leaves of Ficus carica was evaluated against Mycobacterium tuberculosis H37Rv using a colorimetric microplate-based assay. The findings revealed that the extract exhibited anti-tuberculosis activity, showing a minimum inhibitory concentration (MIC) value of 1600 $\mu$g/mL. [30]

**9. ANTICANCER PROPERTY :-**

A blend of 6-O-acyl-$\beta$-d-glucosyl- $\beta$-sitosterols has been extracted as a potent cytotoxic agent from fig (Ficus carica) latex, demonstrating in vitro inhibitory effects on the proliferation of different cancer cell lines. [31]

**10. IRRITANT POTENTIAL :-**

The methanol extract and isolated triterpenoids from Ficus carica leaves were evaluated for irritant activity, demonstrating their potential to cause irritation on mice ears. Among these compounds, calotropenyl acetate, methyl maslinate, and lupeol acetate showed the most potent and persistent irritant effects, falling below those of euphorbium and similar to psoralen. The assessment of irritant potential was conducted using the open mouse ear assay. [32]

**11. ANTIHELMINTHIC PROPERTY :-**

The study examined the anthelmintic properties of the latex from F. carica in NIH mice naturally carrying Syphacia obvelata, Aspiculuris tetraptera,

and Vampirolepis nana. The latex, administered at 3 mL/kg/day for three consecutive days, was found to effectively remove S. obvelata (41.7%). However, it did not significantly eliminate A. tetraptera (2.6%) and V. nana (8.3%). The researchers observed high acute toxicity with hemorrhagic enteritis. Due to its weak anthelmintic efficacy and observed toxicity, the use of this latex in traditional medicine was not recommended. [33]

**12. OXIDATIVE STRESS :-**

Oxidative stress was assessed in rats distributed across four groups: streptozotocin-induced diabetic rats (n = 10), diabetic rats administered a single dose of a basic fraction of F. carica extract (n = 14), diabetic rats given a single dose of a chloroform fraction of the extract (n = 10), and normal rats (n = 10). Compared to the normal rats, the diabetic rats displayed significantly elevated values for erythrocyte catalase normalized to haemoglobin levels (1.5 ± 0.15 vs. 0.96 ± 0.18 µg/mg) and for plasma vitamin E (73.4 ± 43.9 vs. 12.0±1.6 mg/L), monounsaturated fatty acids (0.219 ± 0.118 vs. 0.067 ± 0.014 mg/mL), polyunsaturated fatty acids (PUFA, 0.567 ± 0.293 vs. 0.175 ± 0.040 mg/mL), saturated fatty acids (0.779 ± 0.262 vs. 0.401 ± 0.055 mg/mL), and linoleic acid (0.202 ± 0.086 vs. 0.106 ± 0.014 mg/mL). Both fractions of F. carica showed the ability to normalize the fatty acid and plasma vitamin E values in the diabetic animals, indicating statistically significant differences in response to diabetes. The vitamin E/C 18:2 ratio was normalized by the administration of the chloroform fraction (to 152.1 ± 80.3 µg/mg), and the vitamin A/C 18:2 ratio was increased in comparison to untreated diabetic rats by the administration of the basic fraction (91.9 ± 14.5 µg/mg). This study confirmed that the antioxidant status was impacted in the diabetes syndrome and demonstrated that F. carica extracts have the ability to restore it. [34]

**Figure no. 1 Ficus carica Linn (1) ripe figs, (2) Ficus carica whole tree, (3) unripe figs, (4) upper dark green surface of leaf, and (5) lower dark green surface of leaf**

## CONCLUSION:

Ficus carica is a significant medicinal plant used for treating various conditions worldwide. Studies have shown its antibacterial, anticancer, antifungal, antihelminthic, anti-inflammatory, and immunostimulant properties. However, some traditional applications, like wound healing and menstrual pain, lack experimental evidence. Different regions use different parts of Ficus carica for treating ailments, necessitating further research. Most studies use crude extracts, making it challenging to identify the exact bioactive compound responsible for its effects. Further research is needed to establish the relationship between phytoconstituents and biological activities, and to provide robust evidence supporting the potential clinical applications of Ficus carica in modern medicine.

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