



## Phytochemistry and pharmacological activities of fig (*Ficus carica*): A review

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### Abstract

Fig (*Ficus carica*) is the first grown tree in food history. It is one of the first fruits to be dried and preserved by humans. The plant has been used traditionally to treat various ailments such as gastric problems, inflammation, and cancer. This article describes the botanical features of fig, its use in traditional medicine as remedies for many health problems, and its biological activities. The leaves and fruits of fig are rich in phenolic compounds, organic acids, and volatiles. However, there is little information on the phytochemicals present in the stem and root. Some of the most interesting therapeutic effects include anticancer, hepatoprotective, hypoglycemic, hypolipidemic, and antimicrobial activities.

**Keywords:** fig, phytochemistry, pharmacological activities

### Introduction

Fig (*Ficus carica*) is one of the oldest known fruit trees in the world. Taxonomically *Ficus carica* L. belongs to the *Urticales* order; *Moraceae* family; and *Ficus* genus that includes 750 species. Fig is mostly grown in Mediterranean climates, but can be grown in more humid regions including the tropics and subtropics. Turkey produces 26% of the total world's figs alone and Egypt, Iran, Greece, Algeria, and Morocco together constitute around 70% of the total world's fig production (FAO, 2006) [9]. In India, its cultivation is mostly confined to western parts of Maharashtra (Pune) and Gujarat, Uttar Pradesh (Lucknow and Saharanpur), Karnataka (Bellary, Cnitradurga and Srirangapatna) and Tamil Nadu (Coimbatore). The important varieties of fig grown in India are; Dinkar, Poona Fig, Conadria, Deanna, Excel, Celeste, Brown Turkey, Brunswick (Magnolia). Fig is extremely drought tolerant once established and commercial production is preferred in dry hot summer but needs regular irrigation for achieving higher yields.

Figs can be eaten fresh, dried or canned and are often used in preparation of jam. Fig being the highly nutritious fruit is rich in calories, proteins, and calcium (higher than milk), iron and highest fiber content. Fig has nutritive index of 11, as against 9, 8 and 6 for apple, raisin and date, respectively. The chemical composition and flavour of fig varies with the cultivar. The total sugar content of fresh fig is 16% and of dried is 52%.

Fig leaves are used medicinally for their diuretic, demulcent, emollient and antihelmintic properties. It is valued for its laxative properties and is used in the treatment of skin infection. The fruit helps to maintain acid alkali balance of the body. Latex of stem is useful to coagulate milk (Morsli *et al.*, 1985) [20]. Many medicinal virtues have been ascribed to the fig. It is considered a restorative food which helps in quick recovery after prolonged illness. It removes physical and mental exertion and endows the body with renewed vigor and

strength. It is an excellent tonic for the weak people who suffer cracks in lips, tongue and mouth.

### Phytochemistry

Fig is considered very important to human beings by playing vital role in reducing cholesterol, strengthening the heart and controlling respiration. Over 100 bioactive compounds have been identified in fig such as arabinose,  $\beta$ -amyrins,  $\beta$ -carotenes, glycosides,  $\beta$ -setosterols and xanthotoxol (Duke, 1992). The most prominent among these are triterpenoids from the roots, leaves and the latex. Metallothionein, a sulfur containing protein, is necessary for normal functioning of brain, as it is produced in small quantity in the brain of humans and animals. (Slatnar *et al.*, 2011) [6].

Figs are an excellent source of carbohydrates, minerals, lipids, phenolics and enzymes (Table 1). It is high-carbohydrate food and a good source of dietary fiber. Ninety-two percent of the carbohydrates in dried figs are glucose, fructose and sucrose. The rest is dietary fiber, insoluble cellulose in the skin, soluble pectin in fruit. A mineral content of figs closely resembles that of human milk. The most important mineral in dried figs is iron. Figs have about 50 % as much iron as beef liver. Calcium and potassium are also present (Lydia, 2009) [8]. Various lipid compounds have been identified from the fruit of the fig tree. The main groups are triacylglycerols, free and esterified sterols, mono- and digalactosyl diglycerides, ceramide oligosides, cerebrosides, esterified sterol glycosides and phosphatidyl glycerols (Kolesnik *et al.*, 1986) [8]. The most common fatty acids in fig are; myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid and linolenic acid (Marwat *et al.*, 2009) [28]. Sitosterol is the most predominant sterol in fig. Fig is a rich source of phenolic compounds with rutin being the most prominent followed by (+)-catechin, chlorogenic acid, (-)-epicatechin, gallic acid and finally, syringic acid (Eberic *et al.*, 2008) [26].

Many proteolytic enzymes such as diastase, esterase, lipase,

catalase and peroxidase (Jeong and Lachance, 2006) [26] are being extracted from fig for commercial purposes. The latex obtained from stem of fig plant contain enzymes such as ficin, proteases, lipodiastases, amylase where as tyrosin, cravin, lipase, are present in skin of fig (Canal *et al.*, 2000) [18].

**Table 1:** Nutritional Composition of Fig.

Protein	1.3 g
Fat (total Lipids)	0.2 g
Carbohydrates	7.6 g
Calories (energy)	80 k Cal
Moisture	88.1 g
Fibre	2.2 g
Minerals	0.6 g
Thiamine	0.1 mg
Calcium	35 mg
Phosphorus	22 mg
Iron	0.6 mg
Vitamin A	80 IU
Vitamin C	2 mg

Source: (Akath *et al.*, 2015) [27].

### Medicinal uses

Figs have been traditionally used as treatment against several medical conditions such as cardiovascular, respiratory, antispasmodic, and anti-inflammatory remedy (Duke *et al.*, 2002) [15]. Certain compounds in leaves and roots of fig have been identified effective against different disorders such as gastrointestinal (colic, indigestion, loss of appetite, and diarrhea), respiratory (sore throats, cough, and bronchial problems), inflammatory, and cardiovascular disorders (Penelope, 1997) [22]. Fresh and dried figs and its syrup have long been appreciated for their laxative action (Morton, 1987) [16]. Figs are good for eye sight and can be used as aid in liver and spleen diseases (Anonymous, 2007)

Some beneficial effects of fig extract have been reported to have therapeutic benefits in cases of hyperglycemia, cancer, helminth infection, hypercholesterolemia, hypertriglyceridemia and bovine papillomatosis (Guarrera, 2005) [23]. The latex of fig is widely applied on warts, skin ulcers and sores and can be taken as a purgative and vermifuge.

### Pharmacological activities

Fig has been reported to exhibit anticancer, antioxidant, antidiabetic, antifungal, antimutagenic activity (Gilani *et al.*, 2008) [5].

**i) Anticancer activity:** Besides polyphenols, benzaldehyde and coumain compounds identified in fig have anti cancer activity. Benzaldehyde has been used successfully to treat terminal human carcinomas. Treatment with benzaldehyde change the cancer cells into keratinized, normal squamous cells. Coumarins, have also been used for the treatment of prostate cancer. In vivo studies of fig extracts have shown highest anti tumor activities (Amara *et al.*, 2008) [3].

A mixture of acyl moeity with minor amounts of stearyl and oleyl, isolated from fig (*Ficus carica*) latex have been shown inhibitory effects on proliferation of various cancer cell lines (Shai *et al.*, 2001) [24].

**ii) Antioxidant activity:** The extract obtained from the fig can be used for its antioxidant activity and the prominent antioxidants present are;  $\alpha$ -tocopherols, flavonoids and phenolic compounds (Sibel *et al.*, 2005) [19]. The highest antioxidant capacity is correlated well with the amounts of polyphenols and anthocyanin in fig (Solomon *et al.*, 2006) [2].

**iii) Hepatoprotective activity:** In vitro tests have shown that on application of fig extract, several changes were induced, indicating promising hepatoprotective activity (Gond and Khadabadi, 2008) [21].

**iv) Antidiabetic activity:** It has been observed that the aqueous decoction of fig leaves causes decline in the levels of total cholesterol and total cholesterol/HDL cholesterol ratio, thus, fig extract shows a clear hypoglycaemic effect. Such an effect cannot be mediated by an enhanced insulin secretion, so as yet undefined insulin-like peripheral effect, may be suggested (Guarrera, 2005) [23]. The addition of fig to diet of insulin diabetes mellitus patients could help to control postpandial glycaemia (Burkill, 2005).

**v) Inflammatory activity:** Fig (0.1-3.0 mg/mL) produces relaxation of spontaneous and low K(+) (25 mM)-induced contractions with negligible effect on high K(+) (80 mM) similar to that caused by cromakalim. Fig (0.6 and 0.12 mg/mL) inhibits the adenosine 5'-diphosphate and adrenaline-induced human platelet aggregation. The presence of spasmolytic activity in the ripe dried fruit of Fig caricapossibly mediated through the activation of K(+) (ATP) channels along with antiplatelet activity provides sound pharmacological basis for its medicinal use in the gut motility and inflammatory disorders (Gilani *et al.*, 2008) [5].

**vi) Antibacterial activity:** *In-vitro* and *in-vivo* tests showed that the aqueous extract from fig reduces the damages (disease incidence and disease severity) caused by bacterial pathogens. The extract shows in vitro antimicrobial activity, against all bacterial strains utilized at different concentrations (106-108 cfu mL<sup>-1</sup>). *In vivo* tests conducted on fig extracts confirmed their antimicrobial activity on Pseudomonas (Balestra *et al.*, 2008) [10].

**vii) Antifungal activity:** Figs have been known to possess anti-fungal activities. In one study a low-molecular-weight protein, isolated from freshly collected latex of the fig recoded antifungal activity (Mavlonov *et al.*, 2008) [13].

**viii) Antiviral activity:** The *in vivo* studies conducted on fig leaf extract was evaluated in Hep-2, BHK21 and CEF human cell lines, showed a significant inhibitory activity with MTC value 0.5 mg/mL, against Newcastle disease virus (NDV). The extract from fig leaves had significant activity against NDV and may have applications in drug preparation (Wang *et al.*, 2005). The water extract of fig leaves possesses distinct anti-HSV-1 effect, low toxicity and directly killing-virus effect on HSV-1. Based on this, its application in the area of medicine, food and drugs has a potential future (Wang *et al.*, 2004).

**ix) Antimutagenic activity:** Antimutagenic activity of fig and

its ability to decrease the chromosome aberrations in meristematic cells marrow cells have been reported (Guarrera *et al.*, 2005) [23]. Comparative assessment of genoprotective properties of peroxidase has revealed higher efficiency of antimutagenic action of peroxidase (Agabeili *et al.*, 2004) [25].

**x) Irritant Potential:** Isolated triterpenoids extracted from the leaves of fig are tested for irritant activity. *In vivo* studies showed that the compounds calotropenylacetate, methylmaslinate, and lupeolacetate are the most potent and importunate irritants which were less than those of euphorbium and close to psoralen (Morton, 1987) [16].

#### xi Cholesterol lowering activity

*In vivo* studies performed using fig extract on HepG2 cells and showed reduced cholesterol levels. Extracts were added to the media in both basal and glucose stimulated conditions and incubated for 48 h. While glucose significantly increased cholesterol secretion ( $17 \pm 0.76$  mg dL<sup>-1</sup>) vs. basal condition ( $6.91 \pm 0.66$  mg dL<sup>-1</sup>), co-incubation with extracts reduced secretion of cholesterol in many concentrations of the stimulated condition. On the other hand, cholesterol content of HepG2 in glucose stimulated condition ( $2.73 \pm 0.39$  mg dL<sup>-1</sup>) showed significant increase compared to the basal status ( $1.96 \pm 0.14$  mg dL<sup>-1</sup>) ( $p < 0.001$ ). These properties making the hydro-extracts of fig leaf a potentially safe intervention to modulate postprandial hyperlipidemia (Fatemi *et al.*, 2007) [1].

#### Conclusion

Fig (*Ficus carica*) has been broadly used as traditional medicine in several countries. All parts of this plant have been used in the treatment and prevention of several complications. Flavonoids are the main bioactive compounds in this plant and different extracts have been found to possess biological activity. Less toxicity of this plant represent the possible uses as therapeutic remedy for several ailments. The leaves of fig contain polyphenols with antioxidant and radical scavenging properties which are potentially beneficial for human health. Fig leaves have been traditionally used to treat diabetes and liver disorders.

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