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Phytochemistry and Ethnopharmacology of *Ficus carica*

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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Review Article

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ABSTRACT

Ficus carica L. (Moraceae) is a plant of great importance in the traditional Arab medicine thanks to its therapeutic properties. This work was carried out in order to contribute to the ethnopharmacological knowledge of this medicinal species. We describe phytochemical compounds and ethnopharmacological properties of *F. carica*, species that has been used in traditional medicine for many decades. Possible trends and perspectives for future research of this plant are discussed, as well. *F. carica* has been found to contain several chemical constituents, mostly polyphenols and flavonoids. With its bioactive compounds, *F. carica* possesses a wide range of biological activities. In traditional medicine, it was reported that *F. carica* was applied mainly as the remedy for ulcers, indigestion and diarrhea. Some published studies have shown a broad spectrum of pharmacological activities, including antibacterial, antioxidant, antitumor, as well as anti-inflammatory activities. This paper reviews the main medicinal uses, phytochemistry and pharmacology of this plant in order to summarize its therapeutic potential and to shed light on gaps necessitating for prospected research works.

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1. INTRODUCTION

The fig tree is called *Kerma* in Arabic and *figuier* in French, it belongs to the Moraceae family and *Ficus* genus that includes 750 species, all growing in warm regions of the globe, whose *Ficus carica* L. (Syn: *F. sycomorus*), typically Mediterranean species, is the most studied. This is a very suitable fruit for extensive farming with its crop hardiness, adaptability to various situations and its easy multiplication [1,2], as he reached the age fruit in one to two years and has a long life [3].

The figs are eaten fresh as well as dried in Mediterranean regions [4]. The fruit is widely used in archaic medicine through its diverse beneficial effects such as antipyretic, tonic, purgative, alexiterique, aphrodisiac, lithontriptique, diuretic, astringent and carminative. It is also used against inflammation, weakness, paralysis, thirst, diseases of the liver and spleen, chest pain, batteries cures, diseases of the head and blood, leprosy, nosebleeds, it also stimulates hair growth [4,2].

It is also known for its antitumor activity against certain types of cancer such as stomach cancer, prostate, colon, liver and testis [5]. By their potential as a functional food, common figs possess nutritional properties, phytochemicals, antioxidant and antibacterial, they are used in traditional medicine for their therapeutic benefit against various disorders. These properties may be due to the presence of different bioactive compounds [6]. Through Moroccan regions, *F. carica* is cultivated species with its various varieties (Kuhlan, Homran, Ghodan, Lkouti ...). It is widely used in Moroccan traditional medicine because of their different pharmacological properties argued by the empirical studies. Based on these considerations, we gathered the information and made a bibliographical synthesis of chemical compounds and ethnopharmacological properties *F. carica*.

2. METHODOLOGY

The current review was achieved using a designed search of the scientific data published about medicinal use, phytochemistry and pharmacological activities of *F. carica*. The searches were carried out using various databases, including PubMed

(<http://www.ncbi.nlm.nih.gov/pubmed>), Science Direct (<http://www.sciencedirect.com/>), Scopus (<http://www.scopus.com/>) and Google Scholar (<http://www.scholar.google.com/>).

3. TAXONOMY AND DESCRIPTION OF *Ficus carica*

In a very brief way, taxonomically *Ficus carica* L. belongs to the Urticales order; Moraceae family; and *Ficus* genus that includes 750 species. The common fig is distributed throughout warm area of the world, it is known around the whole of Mediterranean areas where it is widely cultivated and consumed.

4. TRADITIONAL USE

Figs have been traditionally used for its medicinal benefits as laxative, cardiovascular, respiratory, antispasmodic and anti-inflammatory remedies [7]. Its fruit is generally referred as figs which have been used as food and medicine for several centuries [8,9]. Its fruit, root and leaves are used in the native system of medicine in different disorders, such as colic, indigestion, diarrhea, sore throats, coughs, bronchial problems, inflammatory, cardiovascular disorders, ulcerative diseases, and cancers [8-12].

5. PHYTOCHEMISTRY

Ficus carica is rich in compounds belonging to different chemical families. Several studies have revealed the presence of phenolic compounds in the extracts of *F. carica* [13,14,15]. The phytochemical screening of *F. carica* leaves methanolic extracts of different Algerian varieties revealed their richness by flavonoids and polyphenols with significant variability between varieties tested [14]. In another recent study, Harzallah et al. [13] showed that the methanol extracts of fruit, pulp peel and pulp are rich on polyphenols, flavonoids, O-diphenols tannins and anthocyanins. This study is focused on three figs of Tunisian varieties and it showed significant difference between these compounds in the tested varieties. On the other hand, the total composition of *F. carica* differs from one region to another for the same variety.

The latex of the fig has a large amount of polyphenols, flavonoids and anthocyanins [16]. Total phenolics and flavonoids content in fig

extracts were estimated and found to be moderated. A large amount of alkaloids was found in the extract of the figs while saponins were present in very small quantities [6]. Figs have the highest global content in minerals and their calcium content comes in second place after oranges, they are also rich in phosphorus. Dried figs are known as a very good source of strontium, magnesium and iron. They are very useful in anemia cases. Figs are a good source of potassium, a mineral that helps control blood pressure. They are rich on fiber compared to all other common fruits and are naturally sweet [3,4,6].

Phytochemical studies revealed the presence of numerous bioactive compounds: arabinose, β -amyryns, β -carotines, glycosides, β -setosterols and xanthotoxol [17,8]. The 6-O-acyl- β -dglucosyl- β -sitosterols along with its palmitoyl, linoleyl, stearyl and oleyl derivatives isolated from the fruit of *F. carica* exhibited strong cytotoxic effect [17,8,12]. It contains the highest levels of polyphenols, flavonoids, and anthocyanins and exhibits the highest antioxidant capacity [16,18].

6. PHARMACOLOGICAL PROPERTIES

6.1 Antibacterial Activity

Infectious diseases represent an important cause of morbidity and mortality among population. Many efforts have been made to discover new antimicrobial compounds from various kinds of sources such as microorganisms and plants. Therefore, pharmaceutical companies have been motivated to develop new antimicrobial drugs in recent years. The drug-resistant bacteria have further complicated the treatment of infectious diseases. Contrary to the synthetic drugs, antimicrobials of plant origin are not associated with many side effects and have an enormous therapeutic potential to heal many infectious diseases [19-22].

In the scenario of emergence of multiple drug resistance to human pathogenic organisms, this has necessitated a search for new antibacterial substances from other sources as plants. Medicinal plants, which represent the backbone of traditional medicine, become in the last few decades the subject of very intense pharmacological studies [20-24]. Screening of plant extracts is often done by disk diffusion method and dilution. Many medicinal plants have

demonstrated an antibacterial activity against different bacterial strains implicating in almost infectious diseases [25-28].

Antibacterial activity of *F. carica* extracts has been widely studied against several bacterial strains [29,30,31] (Table 1). These extracts of the leaves have been shown to be effective in the inhibition of bacterial growth [28,29]. The antibacterial activity of *F. carica* is certainly depends on polyphenols and flavonoids in the chemical composition of leaves extracts. Indeed, these phenolic compounds have various biological activities including antibacterial activity [29,31]. Lee et Cha, showed that *F. carica* leaves methanolic extract inhibits the growth of clinical isolates of *Staphylococcus aureus* resistant to penicillin. In addition, this extract had an additive effect when tested in synergy with antibiotics [30]. Its action was mainly linked to the cell loss of viability that the properties of phenolic compounds to cross the bacterial membrane. The methanol and ethanol extracts of the fruit of *F. carica* were tested by Jasmine et al., against *Escherichia coli*, *Pseudomonas aeruginosa*, *Streptococcus sp.*, *Enterobacter sp.*, *Klebsiella pneumonia*, *Salmonella typhi* et *Salmonella paratyphi* [31]. Weli et al. [32] investigated the antibacterial activity of the extracts of chloroform, hexane, ethyl acetate and alcoholic. Ethyl acetate extract showed a significant zone of inhibition against *S. aureus*. While in another study carried out by Jeong et al. [29] the ethanol leaves extracts was tested against several bacterial strains and the results have shown an inhibitory activity against *Streptococcus anginosus* at a concentration of MIC = 0.156 mg / ml (Table 1).

6.2 Antioxidant Activity

The antioxidant activity of a product is expressed by its ability to give electrons or protons to substrates oxidized to reduce their. It is well-known that *F. carica* products from latex and fruit are rich in phenolic compounds (Polyphenols, Flavonoids, Tannins, etc ...) with an antioxidant power. Using different systems, several organic extracts from *F. carica* have proved capable of reducing free radicals (Table 1). Indeed, very recently study focused on the evaluation of the antioxidant activity of *F. carica* methanolic extract showed a significant reduction of DPPH radical at low concentrations [14]. Another work carried out by Crisosto et al. [33] demonstrated that fresh figs cultivar has a high levels of antioxidants. Latex of *F. carica* is very rich in

polyphenols and flavonoids, which have been widely shown to be potent antioxidants [27]. In a study carried out on polyphenols and flavonoids extracted from *F. carica* latex and used the radical-scavenging activity *in vivo* assay system *via* the determination of the activity of superoxide dismutase and glutathione reductase, Aziz showed a significant reduction in the rate of these two enzymes in liver cells [34]. *In vitro* antioxidant activity of *F. carica* leaves methanolic extracts was also evaluated using the scanning technique of the radical DPPH by Eteraf-Oskouei et al. [35] showed that antioxidant capacity (IC₅₀) is 0.0903 mg /mL. While Javed et al. [28] found an inhibition of 10.222 DPPH radical at a concentration of 250 mcg / ml.

6.3 Anti-inflammatory Activity

By its high anti-inflammatory compounds, pure products and extracts of *F. carica* showed potent anti-inflammatory activity whether *In vitro* and *In vivo* [36,37,34,35,38,39]. In an animal model, the petroleum ether, chloroform and ethanol extract of *F. carica* showed significant anti-inflammatory effects. These effects are mainly due to the induction reducing cariogenic and granuloma formation. They are correlated with high levels of flavonoids (very molecules recognized for their anti-inflammatory properties) present in these extracts [39].

In other preclinical studies on animal models, the anti-inflammatory activity has been proven. Indeed, the hydroalcoholic extract administered orally has proven effective against induced inflammation in rats. This extract inhibits the inflammatory process in two phases (exudation and granulation) with a dose-dependent response. This dose-dependent response in the inhibition of exudation and granulation was confirmed even with chronic models. Treatment with sodium diclofénaque also sparked inhibitory effects on both phases of inflammation. The effect of sodium diclofénaque was higher than that of the hydroalcoholic extract of *F. carica* [38].

Free radicals are known to play a role in tissue injury and inflammation. The work of Eteraf-Oskouei et al. [38] showed that treatment with *F. carica* leaves methanolic extract is greatly reduced induced angiogenesis in rats.

This extract contains a high total phenolic content indicating its high antioxidant properties responsible for anti-inflammatory and anti-angiogenic activities. These results show that the extract inhibits the production of pro-inflammatory cytokines, including TNF and PGE2 that cause joint damage inducing activation and recruitment of leukocytes into inflammatory exudates in the experimental arthritis model.

With the aim to seek a hepatoprotective effect of *F. carica* latex, Aziz induced in rats oxidative stress using hepatotoxic property lead acetate. The results revealed a significant reduction of histological alterations in animals; this may be due to the high total content of the latex in polyphenols and flavonoids [34]. Aziz has proposed three mechanisms for this reduction: (1) the reduction of oxidative stress, (2) increasing the level of oxidative enzymes and (3) acting as chelators of lead ions. The hepatoprotective effect of *F. carica* has also been shown by the petroleum ether extract [37]. Induced hepatotoxicity in rats' rifampicin and hepatocytes were comparably reformed to normal people. In a recent study by Allahyari et al. [36] on general toxicity and antioxidant activity of *F. carica* leaves extract against ischemic heart disease induced in rats, the results showed that this extract had a significant effect on reducing the size and infarct volume. The mechanisms of this protection are probably due to the antioxidant capacity of phenolic compounds present in *F. carica* extract.

6.4 Antitumor Activity

Cancer is the uncontrolled growth and spread of cells. It can affect almost any part of the body. The growths often invade surrounding tissue and can metastasize to distant sites. Chemotherapy and radiotherapy, the conventional cancer treatments used nowadays, are expensive and cause many side effects, including such minor ones as vomiting, alopecia, diarrhea, constipation, and major ones such as myelosuppression, neurological, cardiac, pulmonary and renal toxicity. For these reasons, the seed of natural products for cancer treatment is very important. Therefore, medicinal plants play a role essential. Several researches have showed cytotoxic activity of medicinal plant [40, 41,42,43,44].

Table 1. Pharmacological properties of *Ficus carica*

Activity	Part of plant	Type of extract/ compound	Experimental model	Effect	References
Antibacterial activity	Leaves	Ethanollic extract	Determination of MIC and MBC against <i>Streptococcus mutans</i> , <i>S. sanguinis</i> , <i>S. sobrinus</i> , <i>S. ratt</i> , <i>S. criceti</i> , <i>S. Anginosus</i> , <i>S. gordonii</i> , <i>Aggregatibacter actinomycetemcomitans</i> , <i>Fusobacterium nucleatum</i> , <i>Prevotella intermedia</i> , and <i>Porphyromonas gingivalis</i> using broth dilution method.	The MIC ranged from 0.156 to 5 mg/ml, while the MBC ranged from 0.313 to 5 mg/ml). The very low MIC was against <i>S. anginosus</i> (MIC =0.156 mg/ml).	[20]
	Leaves	Methanolic extract	Determination of diameter inhibition of methanolic leaves extracts against <i>Klebsiella pneumoniae</i> , <i>B. cereus</i> , <i>E. aerogens</i> , <i>B. substilus</i> and <i>S. epidermidis</i> by using agar well diffusion assay.	Zone inhibition against bacterial strains tested were depended on concentration use of extract.	[28]
	Fruit	Ethanollic and methanolic extract.	Inhibition zone, MIC and MBC were determined for ethanolic and methanolic extract against <i>E. coli</i> , <i>Pseudomonas aeruginosa</i> , <i>Streptococcus sp.</i> , <i>Enterobacter sp.</i> , <i>Klebsiella pneumonia</i> , <i>S. typhi</i> , <i>S. paratyphi</i> by sing disc diffusion and micro-well dilution essay.	Effect of ethanolic extract of <i>Streptococcus sp.</i> at 0.94 µg/ml.	[31]
	Leaves	Methanolic extract	The Minimum inhibitory concentration and minimum bactericidal concentration were determined using well-dilution method.	Effect against methicillin-resistant <i>Staphylococcus aureus</i> (MRSA) isolated in clinic. The MeOH extract has a MICs ranging from 2.5 to 20 mg/mL and a MBC range from 5 to 20 mg/mL.	[30]
	Leaves	hexane, chloroform, ethyl acetate and aqueous alcoholic extract	Inhibition diameter of four extracts were determined by disc diffusion and micro-well dilution	Inhibition of <i>S. aureus</i> , <i>E. coli</i> and <i>P. aeruginosa</i>	[32]
	Leaves	Methanolic extract	Zone inhibition were determined by disc diffusion assay and MIC were measured using microdilution assay.	Among the bacterial strains tested, a significant effect of methanolic extract against <i>B. cereus</i> and <i>S. aureus</i>	[14]
Antioxidant activity	Leaves	Methanolic extract	DPPH scavenging activity.	Inhibition of DPPH depending on origin of <i>F. carica</i> area	[14]
	Fruit pulp, Peel and pulp	Methanolic extract	DPPH scavenging activity and reducing power (RP).	Different fig juices extracts exhibited the same antioxidant capacity in both systems tested and at different concentrations.	[13]

Activity	Part of plant	Type of extract/compound	Experimental model	Effect	References
Anticancer activity	Leaves, pulps and peels	Aqueous extract	Nitric oxide scavenging activity, DPPH scavenging activity and Superoxide radical Scavenging activity.	All extracts exhibited an activity against DPPH and nitric oxide radicals in a concentration-dependent way. However, only the leaves presented capacity to scavenge superoxide radical.	[15]
	Leaves	Phenols and flavonoids	DPPH scavenging activity.	The antioxidant capacity was $IC_{50}=0.06666$ mg/ml.	[36]
	Latex	Phenol and flavonoids	Determination of superoxide dismutase activity	Decreased levels of liver reduced glutathione (GSH) and superoxide dismutase	[34]
	Leaves	Methanolic extract	DPPH radical scavenging assay	The extract had significant antioxidant capacity ($IC_{50}= 0.0903$ mg/mL)	[35]
	Fruit	Ethanol extract	Reducing ferric ions activity	A significant reduction in ferric ions depending on concentration of extract	[48]
	Leaves	Methanolic extract	DPPH radical scavenging assay	Inhibition of 10.222 of DPPH radical at 250 (μ g/ml) of methanolic extract	[28]
	Fruit, leaves and latex	Ethanol, ethyl acetate and dichloromethane extract	Ethanol extracts of leaves and fruits were prepared through percolation and ethyl acetate and dichloromethane extracts were prepared by reflux method. These extracts were tested for these cytotoxic activity using the MTT assay	Latex and different extracts of <i>F. carica</i> could reduce the viability of the HeLa cells at concentrations as low as 2 μ g/mL in a dose dependent manner. The approximate IC_{50} values of the ethanol, ethyl acetate and dichloromethane extracts of the leaves and fruits were 10, 19, 12 μ g/mL and 12, 12, 11.5 μ g/mL, respectively. The IC_{50} for the latex was about 17 μ g/mL.	[47]
	Fruit	Ethanol	Cytotoxic activity against the breast cancer cell line (MCF7) using MTT assay	At 31.2 μ g/ml of extract the inhibition of 47.62% of MCF7	[49]
	Latex	Latex	Fig tree latex including 2.5 mg/ml, 5 mg/ml, and 10 mg/ml on esophageal cancer cell line using MTT assay	10 mg/ml treatment of latex after 72 hours on esophageal cancer line, At mg/ml was the optimum concentration in the inhibition of cell line growth.	[46]
-	polysaccharides	<i>In vitro</i> proliferation assays on the D2SC/1 cell line is a retrovirally immortalized dendritic cell line. The mechanisms of action were determined using Western Blot Analysis, RNA Isolation, Quantitative Real Time PCR (qRT-PCR) and Flow Cytometry Bone Marrow-Derived DC (BMDC).	FCPS could effectively stimulate DCs, partially through the dectin-1/Syk pathway, and promote their maturation, as shown by the up-regulation of CD40, CD80, CD86, and major histocompatibility complex II (MHCII). FCPS also enhanced the production of cytokines by DCs, including IL-12,	[45]	

Activity	Part of plant	Type of extract/ compound	Experimental model	Effect	References
Anti-inflammatory activity	Latex and soybeans	6-O-acyl-beta-D-glucosyl-beta-sitosterols, acyl moiety and linoleyl with minor amounts of stearyl and oleyl, Methanolic extract	MTT assay	IFN- γ , IL-6, and IL-23. Moreover, FCPS-treated DCs showed an enhanced capability to stimulate T cells and promote T cell proliferation. Both the natural and the synthetic compounds showed <i>in vitro</i> inhibitory effects on proliferation of various cancer cell lines.	[12]
	leaves	Methanolic extract	Toxicity test was carried out by brine shrimp lethality assay, the cardiac arrhythmias were analyzed and TTC method was used for infarct size determination.	LD ₅₀ value by brine shrimp test was 0.158 mg/ml, the extract decreased number of VEBs, incidence and duration of Rev VF with clear reduction in infarct size and infarct volume.	[36]
	Leaves	Petroleum ether	Antihepatotoxic activity on rats treated with 50 mg/kg of rifampicin orally. The parameters assessed were serum levels of glutamic oxaloacetate transaminase, glutamic pyruvic transaminase, bilirubin and histological changes in liver.	Petroleum ether extract was significant reversal of biochemical, histological and functional changes induced by rifampicin treatment in rats.	[37]
	Latex	Pure extract	Determination of superoxide dismutase activity, determination of Liver Reduced Glutathione (GSH), determination of Liver Enzymes, determination of Liver Homogenate Lead Level, and histological analysis using electron microscopy scanning.	This extract has decreased levels of liver reduced glutathione (GSH) and superoxide dismutase (SOD), histologically and ultrastructurally, the liver showed several histological alterations such as degeneration of hepatocytes by necrosis and apoptosis, fatty changes and inflammatory cells infiltration.	[34]
	Leaves	Methanolic extract	Creation of Air Pouch Type Inflammation by Carrageenan in Rats. The inflammation was induced by injection of carrageenan into pouches and the Angiogenesis of granulation tissues was determined by measuring hemoglobin content. Quantification of cell migration and exudation, determination of TNF α , PGE ₂ , and VEGF concentrations in the pouch fluid. Determination of granulation tissue weight and determination of angiogenesis in granulation tissue.	Treatment of Leukocyte by extract has an effect on accumulation and volume of exudates were significantly inhibited by the extract. Decreases the production of TNF α , PGE ₂ , and VEGF. On other hand the angiogenesis was significantly inhibited by all administered doses. The extract has also anti-inflammatory effects and ameliorated cell influx and exudation to the site of the inflammatory response.	[35]

Activity	Part of plant	Type of extract/ compound	Experimental model	Effect	References
	Fruit	Hydroalcoholic extract	Anti-inflammatory activity in mice induced by sodium diclofenac, Measure of weight granuloma in mice.	Hydroalcoholic extract of fruit of <i>Ficus carica</i> responsible in changing various biochemical parameters such as serum SGOT, SGPT, ALP and total protein which was not that much significant. In hematological parameters, the hydroalcoholic extract of fruit of <i>Ficus carica</i> showed significant decreased in WBCs.	[38]
	Leaves	Petroleum ether, chloroform and ethanolic extract	Carrageenan-induced rat paw edema and cotton pellet granuloma methods. The extracts were administered orally in doses of 300 and 600 mg/kg/day of body weight to healthy animals. The extracts were administered orally in doses of 300 and 600 mg/kg/day of body weight to healthy animals. The extracts were administered orally in doses of 300 and 600 mg/kg/day of body weight to healthy animals. The extracts were administered orally in doses of 300 and 600 mg/kg/day of body weight to healthy animals. The extracts were administered orally in doses of 300 and 600 mg/kg/day of body weight to healthy animals. The extracts were administered orally in doses of 300 and 600 mg/kg/day of body weight to healthy animals. The extracts were administered orally in doses of 300 and 600 mg/kg/day of body weight to healthy animals.	The ethanolic extract, at 600 mg/kg, exhibited maximum anti-inflammatory effect, which is 75.90% in acute inflammation and in chronic study showed 71.66% reduction in granuloma weight. The petroleum ether (PEE), chloroform (CE) and ethanol (EE) extracts significantly reduced carrageenan-induced paw edema and cotton pellet granuloma method in rats.	[39]
Antipyretic activity	Leaves	Ethanolic extract	Study on normal body temperature induction of yeast-induced pyrexia	Ethanolic extract of <i>F. carica</i> , at doses of 100, 200 and 300 mg/kg body wt. p.o., showed significant dose-dependent reduction in normal body temperature	[2]
Anti-acne activity	Fruit and leaves	Petroleum ether, chloroform, methanol and distilled water extract	Anti-acne activity was evaluated against <i>Propionibacterium acnes</i> using agar disc diffusion method And the minimum inhibitory concentration was calculated by using serial tube dilution method.	Leaves and fruits of <i>F. carica</i> , their water extracts were found to be most effective against <i>P. acnes</i> with a Minimum Inhibitory Concentration of 10µg/ml.	[50]

Several studies revealed the efficacy of the extracts and / or compounds from *F. carica* in the inhibition of human tumor cells. Indeed, beta-sisterol (latex isolated molecule *F. carica*) showed inhibitory activity on the proliferation of tumor cells *In vitro* [12]. The *F. carica* extracts containing polysaccharides have showed antioxidant, antitumor and immunomodulatory [45]. Indeed, these molecules activate dendritic cells, partially by Dectin-1/Syk pathway, and promote their maturation which induce the production of inflammatory factors (the production of multiple cytokines), thus increasing the response of T cells. Although many other studies have demonstrated the immunostimulatory capacity, mechanistic pathways involved in this activity are far from clear [45].

Ficus carica latex showed cytotoxic against tumor lineage of stomach cancer and the tumor line of cancer of the esophagus in a dose dependent manner [46]. In another study, the ethanol extract, ethyl acetate and dichloromethane *F. carica* sheets and plain latex showed moderate cytotoxicity against the tumor lines HeLa [47].

Using extracts from *F. carica* leaves, Aghel et al. [48] showed a hepatoprotective effect of hepatocytes treated with carbon tetrachloride at a dose of 200 mg / kg. In a recent study, *F. carica* leaves ethanolic extract were present an anticancer activity against tumor cell lines of breast cancer [46]. This activity is due to its cytotoxic properties that could be related to the induction of apoptosis and / or necrosis.

6.5 Antipyretic Activity

Several studies have revealed the antipyretic activity of figs. Indeed, the leaves ethanolic extracts were tested by Vikas et al. [2], and showed a significant reduction in body temperature, their effect is comparable to that of paracetamol. This effect may be related to the inhibitory action of these extracts on heat shock proteins or due to their effect on the thermoregulatory center.

6.6 Others Effects

Some compounds found in *F. carica* such as α and γ tocopherols have several biological properties. Indeed, the alpha tocopherol (Vitamin E) has been long considered a powerful antioxidant, improves the immune system and

metabolism, reduces the risk of cancer and cardiovascular disease and prevent cataract. While Gamma tocopherol was found to reduce inflammation and regulate the factors that protect against some cancers [6]. Fig has also a laxative effect that is probably due to the seeds and fibers of combined with some specific solvent present in juice. For example, the fruit juice with honey is used to stop the bleeding. Figs are also used for diseases of the liver, spleen, kidney calcification and its bark was very useful to soothe ulcers caused by burns when it was boiled in water with *Azadirachta indica* and mango [4]. On other hand, the fig latex has and anthelmintic activity and especially against *Ascaris Tricharus*. This effect has been attributed to the presences of laticine in fig latex (enzyme that has been recognized for its anthelmintic activity) [4]. The hypoglycemic effect was also confirmed in patients suffering from diabetes type 1, by associating their treatment of the leaves of the fig tree, the consumption of insulin was reduced by 12% with a significant cholesterol reduction of spleen [49,10].

7. CONCLUSION

Ficus carica has been broadly used as traditional medicine in several countries. As argued below, 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.

This review has presented a comprehensive view about the phytochemistry and pharmacology of *F. carica*. However the research is very limited in some areas and further study on phytochemicals and their mode of actions revealing pharmacological effects are required to fully understand in concern with the traditional uses. In addition majority of medicinal studies were conducted using crude and poorly other solvent extracts. In such case more bioactive compounds should be identified through bioassay guided isolation. More clinical studies on the toxicity of extracts from different parts and the isolated compounds from this plant need to be assessed for ensuring the safe application as modern medicines in Morocco.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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