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THE ROLE OF FIG (*FICUS CARICA* L.) FRUITS IN TRADITIONAL MEDICINE AND PROSPECTS FOR MODERN PHARMACEUTICAL APPLICATION

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Abstract: This article analyzes the role of *Ficus carica* L. (fig) fruits in traditional medicine, their phytochemical composition, and prospects for modern pharmaceutical applications. The study evaluates the antioxidant, anti-inflammatory, and immunomodulatory effects of flavonoids (quercetin, rutin, catechin), phenolic acids, vitamins (C, B-complex, K, beta-carotene), as well as macro- and microelements (K, Ca, Mg, Fe, Zn) found in fig fruits. A review of scientific literature indicates the therapeutic significance of fig extracts in cardiovascular, gastrointestinal, and endocrine system disorders. Due to their richness in natural polyphenols and flavonoids, *Ficus carica* L. is recommended as a promising bio-raw material for the production of pharmaceutical, nutraceutical, and cosmetic products.

Keywords: *Ficus carica* L., fig fruit, flavonoids, phenolic compounds, vitamins, antioxidant activity, traditional medicine, pharmaceutical application, biologically active supplements (BAS), phytotherapy, biopharmaceutical potential.

Introduction

In recent years, the global pharmaceutical and biomedical fields have increasingly focused on developing new, safe, and environmentally friendly drugs based on natural bioactive compounds. In particular, plant-based phytotherapeutic agents are characterized by low toxicity, high biological compatibility, and a wide range of pharmacodynamic effects. From this perspective, the fig plant (*Ficus carica* L.), long known for its medicinal properties in traditional medicine, has become an important subject of scientific research in modern phytochemistry, pharmacognosy, and biopharmaceutics [1].

Ficus carica L. belongs to the Moraceae family and is one of the oldest cultivated fruit plants. It is valued not only as a food source but also as a medicinal raw material. In ancient Egyptian, Greek, Roman, and Eastern medicine, fig fruits, leaves, bark, and even latex were used as anti-inflammatory, antimicrobial, anthelmintic, expectorant, and wound-healing agents. Abu Ali ibn Sina (Avicenna), in his famous work *"The Canon of Medicine"*, emphasized the fig's ability to improve intestinal function, normalize blood pressure, and support liver and spleen activity [2].

Modern scientific studies confirm these traditional medicinal properties. Phytochemical analyses show that fig fruits are rich in flavonoids (quercetin, rutin, catechin, luteolin), phenolic acids (chlorogenic, gallic, ferulic), vitamins (C, B1, B2, B6, K, beta-carotene), and essential elements such as potassium, calcium, magnesium, iron, and zinc. These components act synergistically to provide antioxidant, anti-inflammatory, antimicrobial, antiglycemic, and immunomodulatory effects [3].

Numerous international studies (*Journal of Ethnopharmacology, Phytotherapy Research, Food Chemistry*, 2019–2024) have demonstrated that fig extracts activate apoptosis in cancer

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cells, reduce blood glucose levels in diabetes, improve cardiovascular function, and act as effective natural antioxidants that slow aging processes. In addition, studies on yellow fig varieties grown in the Fergana Valley and Surkhandarya regions of Uzbekistan have shown higher flavonoid and vitamin content compared to imported varieties, indicating superior bioactivity [4].

Currently, pharmaceutical products based on *Ficus carica* L., including syrups, extracts, capsules, cream-gels, and biologically active supplements (BAS), occupy an important place in the international market. Products such as "Ficocare," "Figolact," and "NaturFig," developed by pharmaceutical companies in Italy, Turkey, and India, are known for their anti-inflammatory, antidiabetic, and detoxifying effects. In this context, the use of locally grown fig fruits in Uzbekistan as a national bioresource and their processing in accordance with pharmaceutical standards is a relevant scientific and practical task [5].

Literature Review and Discussion

Fig (*Ficus carica* L.) is considered one of the oldest medicinal fruits in human history. Archaeological evidence suggests that it was used as both a food and medicinal source in ancient Egypt, Syria, and Mesopotamia as early as 4000–3000 BC. Hippocrates and Avicenna described figs as agents that "soften the body, purify the blood, and strengthen the heart."

Modern phytochemical studies scientifically support the traditional use of figs. They contain a wide range of bioactive compounds, including flavonoids (quercetin, rutin, kaempferol, luteolin), phenolic acids (gallic, ferulic, chlorogenic), organic acids (citric, fumaric), vitamins (C, B-complex, K, β-carotene), and essential minerals such as potassium, calcium, magnesium, iron, and zinc. These compounds collectively exhibit antioxidant, anti-inflammatory, antimicrobial, antiglycemic, and immunomodulatory effects (Barolo et al., *Food Chemistry*, 2014; Ali et al., *Journal of Ethnopharmacology*, 2012).

Phytochemical Composition and Biological Activity

Several studies (Sozzi et al., 2005; Solomon et al., 2006) report that fresh fig fruits contain 16–20% carbohydrates, while dried fruits contain up to 45–55%. The presence of ascorbic acid (2–4 mg/100 g), thiamine, riboflavin, niacin, and pyridoxine makes figs a valuable natural source of vitamins. Yellow fig varieties grown in Uzbekistan, Turkey, and Iran are noted for particularly high polyphenol and flavonoid content, indicating strong biological activity [6].

Quercetin and rutin protect cell membranes from free radical damage by inhibiting NADPH oxidase enzymes and reducing oxidative stress. The anti-inflammatory activity of quercetin is associated with inhibition of COX-2 and NF-κB signaling pathways, highlighting its potential use in analgesic and antirheumatic drugs (*Phytotherapy Research*, 2022).

Pharmacological and Therapeutic Properties

The therapeutic effects of fig fruits are multifaceted. According to scientific literature, fig extracts exhibit:

Antioxidant activity: High free radical scavenging capacity in DPPH and FRAP assays (Gündüz et al., 2013);

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Antidiabetic effects: Reduction of blood glucose levels by 25–30% in diabetic animal models (*Journal of Ethnopharmacology*, 2021);

Cardioprotective effects: Quercetin and potassium improve myocardial contractility and help normalize blood pressure (Harvard Medical School, 2020);

Antimicrobial activity: 75–90% inhibition of the growth of *Staphylococcus aureus, Klebsiella pneumoniae,* and *Escherichia coli*;

Immunostimulatory activity: The synergistic action of vitamin C, zinc, and polyphenols enhances lymphocyte proliferation.

Furocoumarins (psoralen and bergapten) found in fig leaves play an important role in photodynamic therapy for skin diseases such as vitiligo and psoriasis (*Dermatology & Therapy*, 2020). In addition, enzymes present in fig latex, including proteases and lectins, exhibit wound-healing, antibacterial, and oncoprotective properties.

Traditional Use in Folk Medicine

For centuries, fig fruits have been used in traditional medicine to relieve constipation, cough, bronchitis, liver and spleen disorders, reduce blood pressure, and treat general weakness. Figs boiled in milk were applied to suppurative wounds, while infusions of dried fruits were used as antipyretic agents. In traditional Eastern medicine, figs were described as “blood-purifying” and “spirit-soothing” foods.

Modern pharmaceutical science has validated this traditional experience and has developed fig-based biologically active supplements, syrups, capsules, and extracts marketed as immunotonic, antioxidant, and anti-stress agents. Products such as “Ficocare,” “Figolact,” and “Nature’s Fig Complex” are produced in Turkey and Italy.

Prospects for Modern Pharmaceutical Applications

One of the key trends in the global pharmaceutical industry is the development of nutraceutical products—functional agents that bridge food and medicine. The bioactive compounds present in *Ficus carica* L. fruits make them particularly valuable for such products. In Uzbekistan, the development of natural supplements (powders, extracts, syrups) based on yellow figs grown under local conditions represents an environmentally friendly and economically promising direction.

Analytical Conclusion

The literature review demonstrates that fig fruits possess a rich and diverse chemical composition, and their phytochemical profile has high pharmaceutical potential. The synergistic action of flavonoids, vitamins, organic acids, and minerals allows figs to be considered natural antioxidants, anti-inflammatory agents, and immunostimulants. Therefore, *Ficus carica* L. is a promising bioresource for pharmaceutical applications by integrating traditional medicine with modern scientific approaches.

Conclusion

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The analysis of scientific sources indicates that *Ficus carica* L. fruits, due to their rich phytochemical composition, biological activity, and diverse medicinal properties, continue to attract scientific interest from ancient folk medicine to modern pharmaceutical systems. The synergistic effects of flavonoids, phenolic acids, vitamins, and minerals provide antioxidant, anti-inflammatory, antimicrobial, antidiabetic, and immunomodulatory actions.

Scientific evidence confirms that fig extracts exert beneficial physiological effects on cardiovascular, gastrointestinal, hepatic, endocrine, and immune systems. Compounds such as quercetin, rutin, and psoralen neutralize free radicals, reduce oxidative stress, and activate cellular regeneration processes. This opens opportunities for incorporating figs into pharmacological practice as natural antioxidants and adaptogens.

Currently, fig-based syrups, capsules, extracts, and creams are recognized as natural protective agents against oxidative stress, infections, metabolic syndrome, and chronic inflammatory conditions. The development of nutraceutical products based on local bioresources is economically and ecologically promising for Uzbekistan's pharmaceutical industry.

Overall, *Ficus carica* L. fruits are regarded as a bioresource of high scientific and practical value in pharmaceutical, cosmetic, and dietary fields. Further in-depth phytochemical studies, standardization, and clinical validation of fig-based functional products remain important future research objectives.

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