Bioactive Compounds in *Ficus* Fruits, Their Bioactivities, and Associated Health Benefits: A Review

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Received 1 February 2022; Accepted 12 March 2022; Published 26 April 2022

Bioactive compounds are secondary metabolites synthesized by plants for maintaining homeostasis; however, they also modulate metabolic processes and demonstrate valuable effects in the human body. The fig was cherished as food and for its pharmaceutical properties. The presence of a wide range of biologically active compounds such as carotenoids, flavonoids, phenols, and vitamin C is obligated for their functional properties as well as their technological capability as a dietary supplement is responsible for most health impacts. Owing to the rich and diversified composition of biologically active compounds these compounds possess different biological properties such as antioxidant, anti-inflammatory, antidiabetic, antimicrobial, and hepatoprotective activity that implies those bioactive substances might be used in the creation of novel culinary and medicinal products. Fig fruit should be widely recognized as a natural functional product. This systematic and comprehensive review gives the notion of developing figs species as a viable and innovative component for its varied food and nonfood applications as a remarkable and primitive source of medication and nourishment.

1. Introduction

Plants serve as an excellent source of food and play a vital role in sustaining human health and improving the quality of life from the beginning of humans on Earth [1]. Underutilized crops have an honest number of phytochemicals and various health benefits; hence, it is often proved as an advantage for the food and pharmaceutical industries. *Ficus* (Moraceae) encompasses 750 species of woody plants found in tropical and semitropical forests throughout the planet. The genus is notable for the wide range of habitats that its species inhabit [2]. As a seasonal fruit, figs establish a significant piece of the Mediterranean diet, either fresh or dried; figs are a particularly good source of fiber, minor elements, proteins, and carbohydrates, making them a very nutritious fruit. Fig fruit cultivars and genotypes are firmly reliant on the concentrations of these compounds. Figs are mainstream high-value fruit because of their pleasant taste as well as their therapeutic properties [3]. A fresh fig can be consumed peeled or unpeeled. Fresh fruits usually have a short postharvest life of 7–10 days at ambient conditions; however, their shelf life is increased up to 2–3 weeks under cooler surroundings and a CO2-advanced atmosphere. Figs are likewise extremely well known as a dried-organic product since their drying drags out their storability [4]. *Ficus* species, such as *Ficus carica*, *Ficus religiosa*, *Ficus benghalensis*, and *Ficus racemosa*, are profoundly related to spiritualism and Hindu religion and utilized for medication to treat different afflictions and irresistible sickness [5]. Fig is high in trace and macroelements, as well as a wide range of biologically active phytochemical constituents, including anthocyanins, carotenoids, flavonoids, polyphenols,
phenolic acids, triterpenoids, glycosides, polysaccharides, reducing compounds, and vitamins C, K, and E. Phytochemical components with high antioxidant potential in terms of chelating metal ions, metal reduction, and free radical scavenging can protect natural frameworks from oxidative stress. Because of their high phytochemical potential and substantial antioxidant ability, these plants exhibit a variety of biological activities such as antibacterial, hepatoprotective, antidiabetic, renal-protective, antibesity, antidiabetic, cardioprotective, and anticancer activity. These plants are viable in the treatment of diabetes, stomachache, piles, skin diseases, inflammation, cancer [6], kidney, and spleen diseases [7].

The phytochemical investigations of Ficus fruit have uncovered the occurrence of ceramides, cerebrosides, steroids, pentacyclic triterpenes, flavonoids, and phenolic compounds [8,9]. The processing of figs generates many by-products. These by-products are derived from fresh figs that were abandoned owing to inadequate or excessive ripening, spoilage, or poor table fruit quality, but are still edible. If the fig coproduct is not used, it represents a considerable economic loss because it is abundant in nutrients and bioactive compounds that may be separated and used as a value-added ingredient. Fig coproducts are rich in minerals, dietary fiber, vitamins, and amino acids [4, 10]. Bioactive compounds such as anthocyanins pigments, flavonoids, and other phenolic substances with antioxidant potential have recently increased attention in fruit composition. Figs are also an incredible source of soluble crude fiber [11]. This overview summarizes research concerning the biological activities of Ficus, their therapeutic properties, and prospects as functional ingredients and food products.

2. Bioactive Compounds in Fresh Fig Fruit and Fruit Products

Fruits and vegetables are colorful, delightful, and nutritious additions to our diets. Because of their potential health benefits, bioactive compounds found in fruits and vegetables such as polyphenols, carotenoids, vitamins, and anthocyanins are receiving more attention. Fruit and vegetable-rich diets may help slow down the aging process and minimize the risk of certain cancers, cardiovascular diseases, and other chronic illnesses. Vitamins, minerals, phenolics, antioxidants, and fiber appear to be responsible for these effects [12].

2.1. Ascorbic Acid. Fig fruit is an excellent source of water-soluble vitamin C, known as a natural antioxidant, and helps in preventing the nonenzymatic browning of fruits and vegetables. It is utilized as a substitute for synthetic antioxidants [13]. The vitamin plays a vital role in the immune reaction, detoxification, iron absorption, wound healing, orthogenesis, collagen biosynthesis, preventing the blood vessels from clotting, and in various metabolic processes [14]. The degrees of ascorbic acid indeed rely upon the species, ecological circumstances, harvest time, manufacturing techniques, development, and storage stages. Different extraction strategies also affect reliability, stability, and vitamin C content [15].

Ascorbic acid has an essential function in human health including the prevention of chronic human diseases such as scurvy, oxidative stress-induced DNA mutations, certain tumors, myocardial infarction, atherosclerosis, glaucoma, and renal disease [16]. Vitamin C also invigorates the immune system of the human body. It obstructs the production of nitrosamines and prevents carcinogens from being stimulated [15]. Vitamin C is one of the most important vitamins in humans, as it is involved in many of the body’s processes and functions. Collagen, or connective tissue, is the amallest tissue in the human body. Collagen protects against sicknesses and contaminations in the human body. The major function of vitamin C is to assist this animal tissue. As a result, scleroprotein has the defense mechanism against sickness and infection, and because vitamin C aids in the formation of collagen, it stands to reason that it can also be used to treat scurvy by contributing to hemoglobin synthesis. Vitamin C is required for promoting carbohydrates and integrating fats and proteins. Vitamin C is a proficient antioxidant. Even if it is used in less amount, vitamin C can protect from vitally important molecules such as amino acids, lipids, carbohydrates, nucleic acids, and other essential components against free radicals and reactive oxygen species which are produced because of exposure to toxins and pollutants (e.g., smoking). Vitamin C may also be able to resuscitate different cancer prevention agents such as vitamin E [17]. Sirajo [18] analyzed that the Ficus carica fruit does indeed have a relatively high ascorbic acid content (37.00 ± 1.59 mg/100 g DW). This value is higher than 7.73 ± 2.83 mg/100 g, 15.87 ± 0.91 mg/100 g, and 33.85 ± 1.92 mg/100 g recorded on a fresh weight basis for Prunus spinosa fruits, African star apple fruits, and Blackberry fruits, respectively. The result revealed that fruits can be a good source of vitamin C, a water-soluble, nonenzymatic natural antioxidant that is extensively used as a substitute for chemically synthesized antioxidants [13]. Table 1 shows the Vitamin C present in the species used as both fresh fruit and spices belonging to genus Ficus.

2.2. Carotenoids. Carotenoids are biologically active compounds extensively located in plants, and they are liable for the color of Ficus species. Carotenoid molecules can serve as antioxidants, defensive cells from oxidative stress, and slow the process of aging by using reactive oxygen species [20]. Fig fruit contains a variety of health-beneficial bioactive ingredients including phenolics, anthocyanins, minerals, carotenes, and sterols. Figs are an exquisite source of crude fiber, minerals [21], phytosterols, carotenoïd [22], anthocyanins [10, 23, 24], and polyphenols [23, 25]. The quality of freshly processed products is indicated by the color of the fruit. Anthocyanins give fruits and vegetables their typical red, purple, and blue hues, along with the goods produced from these materials. Similarly, typically yellow and orange hues of many foods are caused by carotenoids, a group of fat-soluble pigments. The recognition of carotenoids emerges from their precursor interest and for nutrition and defensive
effect against cancer and cardiovascular diseases. It has been noted that certain anthocyanins and carotenoids have entirely distinct functional characteristics [26]. Fresh figs are an excellent source of anthocyanins and carotenoids and relish growing popularity. The concentration profile of carotenoids in fig varies as per species, as shown in Table 2, considering factors such as growing circumstances, plant component, maturity stage during harvest, and postharvest management practices. Furthermore, adequate sample preparation and extraction are required to retain the optimum level of carotenoids in fruit [15]. Information about the chemical structure of figs and the number of individual anthocyanins and carotenoids is crucial [11]. Although in modest quantities, figs contain all the main carotenoids seen in plasma [22], a multitude of factors impacts carotenoid concentration in vegetables, including the type of soil, cultivar, variety, and fruit maturity. β-cryptoxanthin, α-carotene derivate, and β-carotene were carotenoids found in Ficus carica [28].

As shown in Table 2, the carotenoids in the figure are positively recognized by zeaxanthin, lutein, α-carotene, lycopene, β-carotene, and cryptoxanthin [11]. Lycopene is the carotenoid found in abundance followed by lutein, β-carotene, α-carotene, and cryptoxanthin [22]. A study of two cultivars of F. carica “Sarizybek” and “Sarilop,” [11], affirmed lutein as the fundamental carotenoid recognized in fresh fig followed by zeaxanthin, β-cryptoxanthin, and β-carotene. Dry figs have far greater total carotenoid levels than apricots, dried prunes, and raisins [28]. The fruit skin is the major source of carotenoids, whereas the pulp contains only a little amount [27]. Thermal treatments expanded the extractability of these pigments, and the antioxidant potential is related to the carotenoid concentration. Mucilage present in the stems diminished the extractability of the carotenoids [29].

2.3. Phenolic Compounds. Phenolic compounds can play a significant part in protecting biological cells from hydrogen peroxide damage, protecting cells and organs from lipid peroxide damage to unsaturated fatty acids, and absorbing and neutralizing free radicals. The genus Ficus contains a high concentration of phenolic components [30]. In consideration of the profile of the bioactive compounds of figs, the variety of their phenolic compounds has been widely explored regarding their therapeutic properties namely the anticipation of anti-inflammatory action, tumor, and atherosclerosis [31]. It is worth mentioning that there is an interrelationship between the antioxidant activities and phenolic compounds of Ficus species, implying that these components are largely accountable for antioxidant capacity in figs. Phenolic compounds in fig fruits significantly contribute to their quality especially because it has been demonstrated that their utilization can positively affect human well-being. The utilization level of phenolic compounds is not only affected by the cultivar of the fruit; however, it differs significantly from one portion to another [4].

Siraio [18] indicated that the Ficus carica fruit if properly utilized can be a good source of polyphenols. Polyphenols are aromatics auxiliary plant metabolites that are widely distributed throughout the plant kingdom and are associated with color, sensory characteristics, antioxidant, and nutritional properties in food. Polyphenols may contribute to bitter taste, astringency, color, flavor, odor, and oxidative stability [32]. Dry figs have one of the highest polyphenol content levels among regularly consumed fruits and vegetables as well. Fruit skin contributed most of the phytochemicals. The total polyphenol content of fig extract is correlated well with the color of the extract. Extract of darker-colored varieties shows the highest contents of polyphenols in contrast to lighter-colored varieties [10]. Abdel-Aty et al. [33] investigated the flavonoid content and total phenolic of Ficus sycomorus latex extracts. Among the investigated methanol extracts, the Ficus sycomorus had the greatest total phenolic and flavonoid concentrations, which were about two and three times higher than Ficus carica, respectively. They concluded that latex from Ficus carica extract, and Ficus sycomores extract contained greater polyphenol and flavonoid content than other fig sections. Ficus sycomorus also contains the highest tannin content and the best antioxidant activity [34]. The polyphenol concentration of Ficus deltoidea extracts is significantly influenced by the temperature at which the extracts are extracted. Numerous plant extracts demonstrated that hot aqueous extraction of Ficus deltoidea yielded higher polyphenol content than cold aqueous extraction [35]. The temperature at which the extracts are extracted has a substantial impact on the polyphenol content of F. deltoidea extracts phenolic compounds such as gallic acid, chlorogenic acid, syringic acid, catechin, and epicatechin were identified, and rutin was present in the highest concentrations among all the phenolics analyzed as shown in Table 3. In comparison to apples, figs contain a high amount of rutin [25]. Epicatechin was found to be the most abundant component of phenol in dried fig fruits, with a level of 25.4 mg/100 g DW in cultivar “Bela Petrovka” of Ficus carica. Its content is up to three times that of fresh figs [36]. In contrast, research using sun-dried pear found that the drying procedure reduced monomeric catechin and epicatechin by 91 and 96%, respectively [37]. Chlorogenic acid levels in dried figs are also greater than in fresh fruits. In comparison to sun-dried fruits, oven-dried fruits have greater polyphenol levels. When compared to sun-drying,
the findings demonstrate that constant temperature can be maintained in oven-drying [36]. According to Devic and Guyot, [38] drying preserves procyanidins better than hydroxycinnamic acids or some monomeric flavanols. BZ_he two phenolic groups that follow are good substrates for enzymatic oxidation. BZ_he drying technique of fig had the same influence on flavanol concentration as it did on the other phenolic categories. In comparison to fresh figs, dried fig samples from “Bela Petrovka” contain a high concentration of kaempferol-3-glucoside, rutin, and quercetin-3-glucoside as shown in Table 3 [36]. Hassan et al. [39] investigated the total phenolic content of the methanol extracts of seven Ficus species (Ficus bengalensis, Ficus decora, Ficus hawaii, Ficus virens, Ficus phatphylla, Ficus retusa, and Ficus cycomorous) tested by the Folin–Ciocalteu method. The phenolic content ranged from 2.50 to 7.97 mg/gm dried extract shown in Table 4. Ficus fruit contains phenolic derivatives which may provide a wide variety of biological activities. Total phenols in dried fruits are considerably greater than in fresh fruits. A study by Vallejo et al. [43] found that phenolic levels in fresh and dried fruit range from 0.5 mg/100 g to 11.3 mg/100 g, with dried fruit levels ranging from 17.8 mg/100 g (Spanish genotype) to 19.2 mg/100 g (Turkish genotype). BZ_he drying procedure resulted in the loss of around 15% of the overall phenol content. Some polyphenols may be destroyed or transformed into forms that are not antioxidants. Water loss results in a 90% increase in free polyphenolic compounds when comparing fresh and dehydrated fig fruit based on fresh weight. Polyphenols are thought to be degraded or transformed into nonantioxidant forms during the aging process [37]. Meanwhile, Vinson et al. [44] found an 11% increase in total phenolic compounds because of drying. This is in accordance with previous findings on other fruit species such as strawberry.

| Carotenoid compounds | Chemical structure | Species | Maximum quantification | Extraction solvent | References |
|----------------------|--------------------|--------|------------------------|-------------------|------------|
| Lutein               | ![Lutein Structure](image) | F. carica | 6.14 µg/gm | Methanol | Yemis et al., [11] |
| Zeaxanthin           | ![Zeaxanthin Structure](image) | F. carica | 3.32 µg/100 gm | Methanol | O. yemis et al., [11] |
| β-cryptoxanthin      | ![β-cryptoxanthin Structure](image) | F. carica | 2.04 µg/100 gm | Methanol | Yemis et al., [11] |
| β-carotene           | ![β-carotene Structure](image) | F. carica | 1.40 µg/100 gm | Acetone | Yemis et al., [11] |
| | F. carica | 0.04 mg/100 gm | Methanol | Ouchemoukh et al., [27] and Yemis et al., [11] |
| | F. carica | 4.32 µg/gm | Ethanol | Ouchemoukh et al. [28] |
| | F. carica | 0.2 mg/100 gm | Methanol | Su et al. [22]; Ouchemoukh et al., [27] and Yemis et al., [11] |
| | F. carica | ND µg/gm | Ethanol | Ouchemoukh et al., [28] |
| Lycopene             | ![Lycopene Structure](image) | F. carica | 3.2 mg/100 gm | Methanol | Ouchemoukh et al., [27] and Yemis et al., [11] |
| α-cryptoxanthin      | ![α-cryptoxanthin Structure](image) | F. carica | 0.1 mg/100 gm | Methanol | Su et al. [22]; Ouchemoukh et al., [27] and Yemis et al., [11] |
| Phenolic compounds | Chemical structure | Species     | Maximum quantification | Extraction solvent |
|--------------------|--------------------|-------------|-------------------------|--------------------|
| Gallic acid        | ![Gallic acid structure](https://example.com/gallicacid.png) | F. carica   | 0.15 mg/100 gm          | Methanol           |
|                    |                    | F. vasta    | 76.36 mg/gm             | Methanol           |
| Chlorogenic acid   | ![Chlorogenic acid structure](https://example.com/chlorogenicacid.png) | F. carica   | 0.46 mg/100 gm          | Methanol           |
|                    |                    | F. vasta    | 0.73 mg/gm              | Methanol           |
| Syringic acid      | ![Syringic acid structure](https://example.com/syringicacid.png) | F. carica   | 0.022 mg/100 gm         | Methanol           |
| Epicatechin        | ![Epicatechin structure](https://example.com/epicatechin.png) | F. carica   | 0.34 mg/100 gm          | Methanol           |
| Catechin           | ![Catechin structure](https://example.com/catechin.png) | F. carica   | 1.19 mg/100 gm          | Methanol           |
| Rutin              | ![Rutin structure](https://example.com/rutin.png) | F. carica   | 4.89 mg/100 gm          | Methanol           |
|                    |                    | F. vasta    | 9.33 mg/gm              | Methanol           |
| 3-Caffeoyquinic acid | ![3-Caffeoyquinic acid structure](https://example.com/3caffeoyquinicacid.png) | F. carica   | 0.32 mg/100 gm          | Methanol           |
| 5-Caffeoyquinic acid | ![5-Caffeoyquinic acid structure](https://example.com/5caffeoyquinicacid.png) | F. carica   | 1.4–32.42 mg/100 gm     | Methanol           |
| Kaempferol-3-rutinoside | ![Kaempferol-3-rutinoside structure](https://example.com/kaempferol3rutinoside.png) | F. carica   | 1.0–2.0 mg/100 gm       | Methanol           |
| Phenolic compounds                  | Chemical structure | Species  | Maximum quantification | Extraction solvent |
|------------------------------------|--------------------|----------|------------------------|-------------------|
| Quercetin-3-acetylglycoside        | ![Quercetin-3-acetylglycoside](image) | *F. carica* | 2.1–2.8 mg/100 gm | Methanol          |
| Quercetin-3-glucoside              | ![Quercetin-3-glucoside](image)     | *F. carica* | 0.56–3.35 mg/100 gm | Methanol          |
| Quercetin-3-rutinoside             | ![Quercetin-3-rutinoside](image)    | *F. carica* | 1.38–14.62 mg/100 gm | Methanol          |
| Ferulic acid                       | ![Ferulic acid](image)              | *F. carica* | 0.92–2.05 mg/100 gm | Methanol          |
| Catechin                           | ![Catechin](image)                 | *F. carica* | 5.88–19.75 mg/100 gm | Methanol          |
| Catechin                           | ![Catechin](image)                 | *F. carica* | 6.53 mg/gm           | Methanol          |
| Epicatechin                        | ![Epicatechin](image)              | *F. carica* | 10.44–36.6 mg/100 gm | Methanol          |
| Kaempferol-3-glucoside             | ![Kaempferol-3-glucoside](image)   | *F. carica* | 0.31–0.43 mg/100 gm | Methanol          |
| Luteolin -8-C-glucoside            | ![Luteolin -8-C-glucoside](image)  | *F. carica* | 0.13–0.45 mg/100 gm | Methanol          |
| Phenolic compounds               | Chemical structure | Species | Maximum quantification | Extraction solvent |
|---------------------------------|--------------------|---------|------------------------|--------------------|
| Cyanidin-3-rutinoside           | ![Cyanidin-3-rutinoside](image) | *F. carica* | 0.12–0.31 mg/100 gm | Methanol           |
| Bergapten                       | ![Bergapten](image)  | *F. carica* | 2.68 mg/100 gm | Methanol           |
| Psoralen                        | ![Psoralen](image)   | *F. carica* | 0.26–1.84 mg/100 gm | Methanol           |
| Protocatechinic acid            | ![Protocatechinic acid](image) | *F. microcapra* | 6.6 mg/gm | Methanol           |
| Catechol                        | ![Catechol](image)   | *F. microcapra* | 11.1 mg/gm | Methanol           |
| Vanillin                        | ![Vanillin](image)   | *F. microcapra* | 4.27 mg/gm | Methanol           |
| Syringaldehyde                  | ![Syringaldehyde](image) | *F. microcapra* | 8.96 mg/gm | Methanol           |
| Syringol                        | ![Syringol](image)   | *F. microcapra* | 173 mg/gm | Methanol           |
| P-vinyl gylaiacol               | ![P-vinyl gylaiacol](image) | *F. microcapra* | 4.40 mg/gm | Methanol           |
| P-propyl phenol                 | ![P-propyl phenol](image) | *F. microcapra* | 10.5 mg/gm | Methanol           |
| Phenolic compounds        | Chemical structure | Species | Maximum quantification | Extraction solvent |
|--------------------------|--------------------|---------|------------------------|--------------------|
| Naringenin               | ![Naringenin Structure](image) | \textit{F. vasta} | 5.84 mg/gm          | Methanol           |
| Isoquercitrin            | ![Isoquercitrin Structure](image) | \textit{F. vasta} | 22.50 mg/gm         | Methanol           |
| Naringin                 | ![Naringin Structure](image) | \textit{F. vasta} | 1.20 mg/gm           | Methanol           |
| Quercetin-3-galactoside  | ![Quercetin-3-galactoside Structure](image) | \textit{F. vasta} | 81.75 mg/gm         | Methanol           |
| Vitexin                  | ![Vitexin Structure](image) | \textit{F. vasta} | 0.64 mg/gm           | Methanol           |
| Kaempferol-3-glucoside   | ![Kaempferol-3-glucoside Structure](image) | \textit{F. vasta} | 6.72 mg/gm           | Methanol           |
| Quercetin                | ![Quercetin Structure](image) | \textit{F. vasta} | 0.98 mg/gm           | Methanol           |
| Luteolin                 | ![Luteolin Structure](image) | \textit{F. vasta} | 0.49 mg/gm           | Methanol           |
Table 4: Total phenols present in the species used as both fresh fruit and species belonging to genus *Ficus*.

| Species       | Maximum quantification | Extraction solvent                      | References                  |
|---------------|------------------------|-----------------------------------------|-----------------------------|
| *F. carica*   | 384 mg/100 gm          | Methanol                                | Sirajo [18]                 |
| *F. sycomorus*| 24700 mg TAE/gm        | Chloroform, ethanol, distilled water    | Ramde-Tiendrebeogo et al., [34] |
| *F. sycomorus*| 33680 mg TAE/gm        | Chloroform, ethanol, distilled water    |                             |
| *F. deltoides*| 2.19 mg GAE/gm         | Aqueous extract                         | Hakiman et al., [35]        |
| *F. afzelii*  | 97.30 mg GA/gm         |                                        |                             |
| *F. decorum*  | 63.61 mg GA/gm         |                                        |                             |
| *F. lycera*   | 131.38 mg GA/gm        |                                        |                             |
| *F. nitida*   | 105.38 mg GA/gm        |                                        |                             |
| *F. sycomorus*| 120.46 mg GA/gm        |                                        |                             |
| *F. virnes*   | 93.50 mg GA/gm         |                                        |                             |
| *F. sycomorus*| 8.75 mg GAE/100 gm     |                                        |                             |
| *F. indica*   | 218.8 mg/100 g         | Methanol                                | Al-matani [41]              |
| *F. racemosa* | 24.63 mg/gm            |                                        | Munira et al., [42]         |
| *F. cycomorus*| 7.97 mg/gm             |                                        |                             |
| *F. decorum*  | 7.60 mg/gm             |                                        |                             |
| *F. benghalensis* | 5.88 mg/gm             |                                        |                             |
| *F. platyphylla* | 4.10 mg/gm             |                                        |                             |
| *F. hawaii*   | 3.91 mg/gm             |                                        |                             |
| *F. retusa*   | 3.77 mg/gm             |                                        |                             |
| *F. virens*   | 2.50 mg/gm             |                                        |                             |

Table 5: Flavonoid compounds present in the species used as both fresh fruit and species belonging to genus *Ficus*.

| Flavonoid compounds | Chemical structure | Species | Maximum quantification | Extraction solvent | References                  |
|---------------------|--------------------|---------|------------------------|--------------------|-----------------------------|
| Quercetin           | ![Quercetin structure](image) | *F. carica* | 63.8 mg/kg            | Ethanol            | Vaya and Mahamood, [48]     |
| Kaempferol          | ![Kaempferol structure](image) | *F. carica* | ND                    | Ethanol            | Vaya and Mahamood, [48]     |
| Luteolin            | ![Luteolin structure](image) | *F. carica* | 1.07 mg/100 gm        | Ethanol            | Viuda-Martos et al., [2]    |
| Rutin               | ![Rutin structure](image) | *F. carica* | 14.20 mg/100 gm       | Ethanol            | Viuda-Martos et al., [2]    |
| Apigenin            | ![Apigenin structure](image) | *F. carica* | 1.03 mg/100 gm        | Ethanol            |                             |
| Flavonoid compounds | Chemical structure | Species | Maximum quantification | Extraction solvent | References |
|---------------------|--------------------|---------|------------------------|--------------------|------------|
| Luteolin-7-O-glucoside | ![Chemical structure](image1) | *F. carica* | 2.18 mg/100 gm | Ethanol | |
|                      | ![Chemical structure](image2) | *F. carica* | 12.48 mg/100 gm | Ethanol | |
| Catechin            | ![Chemical structure](image3) | *F. carica* | ND | Ethanol | Vaya and Mahamood, [48] |
| Epicatechin         | ![Chemical structure](image4) | *F. carica* | 2.25 mg/100 gm | Ethanol | Viuda-Martos et al., [2] |
| Myricetin           | ![Chemical structure](image5) | *F. carica* | ND | Ethanol | |
| Naringenin          | ![Chemical structure](image6) | *F. carica* | ND | Ethanol | |
| Hesperetin          | ![Chemical structure](image7) | *F. carica* | ND | Ethanol | Vaya and Mahamood, [48] |
| Daidzein            | ![Chemical structure](image8) | *F. carica* | ND | Ethanol | |
| Genistein           | ![Chemical structure](image9) | *F. carica* | ND | Ethanol | |
| Biochanin           | ![Chemical structure](image10) | *F. carica* | 17.4 mg/kg | Ethanol | |
| Taxifolin           | ![Chemical structure](image11) | *F. carica* | ND | Ethanol | |
apple, and peach wherein the concentrations of total phenolic content rose after drying the fresh fruit purees [45].

In many foods, pigment loss occurs mostly throughout the drying process. Some processes during the drying process, such as browning reaction enzymatic, nonenzymatic browning, and caramelization, produce color modifications in the food item, resulting in a deeper color [46].

2.4. Flavonoids. Flavonoids are compounds present in a wide range of edible plants, fruits, vegetables, and grains, and they constitute an indispensable and essential component of the human diet. Flavonoids and foodstuffs containing them (wine, tea, soybeans, and licorice) have been investigated as potential health advantages owing to their antioxidant activity and capacity to postpone or retard many disorders thought to be connected to oxidative stress (atherosclerosis, cancer, Parkinson’s, and diabetes) [47]. Fig fruits are a rich source of flavonoids. The attractive color of flowers is also due to the presence of flavonoids, fruits, and leaves of Ficus species and possesses biological activities such as anticarcinogenic, anti-inflammatory, and antiatherosclerotic activities. The primary flavonoids found in figs are quer cetin and luteolin, which have a total of 631 and 681 mg/kg, respectively, as shown in Table 5. The major flavonoid compound (nonglycosylated) in fig is found to be luteolin (187 mg/kg extract). Luteolin was shown to be the most abundant flavonoid in fig leaves. Another flavonoid found in the figure, but in lesser amounts, was biochanin A, which was found mostly as a free aglycone [18]. Ficus ceraton a are rich in flavonoids and also contain a high level of significant isoflavone, genistein [48]. Nawaz et al. [6] reported that Ficus carica contains flavonoids, alpha-tocopherol, and phenolic acids in its leaves, as well as sesquiterpenes and organic acids in its latex [49]. Ficus deltoidea hot and cold aqueous extracts have flavonoid contents given in mg as catechin equivalent (CE)/g of fresh weight. This study found that the total flavonoid content of hot aqueous extract ranged from 17 to 66 mg CE/g fresh weight, whereas that of cold aqueous extract was in the range of 18 to 52 mg CE/g fresh weight [35]. The absolute flavonoid content of the six cultivars of Ficus carica was calorimetrically measured and discovered to be altogether higher in dark varieties when compared to light-colored varieties. Most of the flavonoids are present in the fruit skin. Total flavonoid ranged from 2.1 mg/100 gm in mission variety of Ficus carica followed by 15.9 mg/gm in chechik, 3.6 mg/gm in Brown–Turkey, 2.7 mg/gm in Bursa, 2.3 mg/100 gm in Brunswick, and 2.1 mg/100 gm in Kadota as shown in the Table 6. Darker variety figs were substantially greater in flavonoid content than those of other varieties. So the skin is the primary tissue that adds the flavonoid content [10]. Hassan et al. [39] examined the total flavonoid content of the methanol extracts of seven Ficus species (Ficus. Benghalensis, Ficus. Decoru, Ficus. Hawaii, Ficus. Virens, Ficus. Phatypylia, Ficus. Retusa, and Ficus sycomorus) using a modified aluminum chloride colorimetric method. As shown in Table 6 the flavonoid content of dried fig species ranged from 1.85 to 12.46 mg/gm. Figs contain flavonoid derivatives which may provide a wide variety of biological activities.

3. Bioactivities of Fig Fruit

3.1. Antioxidant Activity. Antioxidants inhibit the production of reactive oxygen species. Total polyphenols, anthocyanins, flavonoids, and antioxidant capacity of fig extract is associated well with the color appearance. Extracts of darker varieties of figs had more phytochemicals than lighter color variants. When compared to fruit pulp, fruit skin contributes the greatest phytochemicals and antioxidant activity [10]. Abdel-Aty et al. [33] compared the antioxidant profile of different fig species. Ficus carica and Ficus sycomorus extracts included a variety of phytochemical substances with potential therapeutic utility, including anticancer, antiapoptotic, anti-inflammatory, and antifungal activities. Variations in the number of antioxidants found in the fig extract make it an excellent source of natural antioxidants for health. Some of these differences may be due to the kind of solvent, the phenolic concentration, and the interaction among extract components. Flavonoid glycosides in the leaves of Ficus pumila are powerful antioxidants that have beneficial effects on the human body. The strongest antioxidant compound rutin was extracted from Ficus pumila leaves using 50% of aqueous ethanol. F. pumila is used as herbal medicine to treat diabetes and high blood pressure [51]. The antioxidant and antibacterial activities of Ficus microcapra extracts were evaluated by [50]. The methanolic extracts of bark, fruits, and leaves show excellent antioxidant activities and have antibacterial activity. Shi et al. [5] studied the antioxidant effects of the edible young leaves of Ficus virens var. Sub lanceolata, Ficus auriculata, Ficus vasculosa, Ficus callosa, and Ficus racemosa along with their total phenolic and flavonoid contents. The ethanol extracts of Ficus virens var. Sub lanceolata and Ficus auriculata showed a substantial level of antioxidant potential as compared with other species that were examined, and it was stated that methanol extract of Ficus microcapra stem bark contains seven distinct antioxidant chemicals, including protocatechuic acid, chlorogenic acid, catechin, and epicatechin. All the substances identified have high antioxidant properties [52].

The methanolic root extract of Ficus hispida and Ficus arnottiana has been investigated for its antiulcerogenic potential. The results have shown that the antiulcer activity is because of the antioxidant activity of the extract. Anti-inflammatory and analgesic effects have been assessed from aqueous and methanolic extracts of Ficus benghalensis. The considerable anti-inflammatory potential is shown by methanolic bark extract as compared to the aqueous extract. The anti-inflammatory activity is primarily because of its antioxidant and lysosomal membrane-stabilizing effects on Ficus benghalensis. Due to their influence on oxidative stress, the flavonoids and tannins in the methanolic extract are liable for anti-inflammatory action [53]. Sertkaya et al. [54] studied the antioxidant activities of the fig peel and pulp samples by measuring the DPPH and ABTS. It was determined that the peels of cultivars had significantly higher total antioxidant activity than the fig pulps. Different species of fig are high in antioxidants, with phenolic compounds and flavonoids playing an indispensable part in preventing a wide range of health
problems associated with oxidative stress, including neurodegenerative diseases, cardiovascular disease, and cancer. *Ficus* species with excellent antioxidant and physicochemical features, as well as the ability to disperse harmful free radicals, make them suitable additives in the nutraceutical and biopharmaceutical sectors [55]. The extract of *Ficus deltoidea* contains potential antioxidant activities that have contributed to total polyphenols, phenolic acids, and flavonoid compounds [35]. Abdel-Hameed [40] examined total phenolic content and free phenolic acids, and flavonoid compounds [35]. Abdel-Hameed [40] examined total phenolic content and free phenolic acids, and flavonoid compounds [35]. Abdel-Hameed [40] examined total phenolic content and free phenolic acids, and flavonoid compounds [35].

In vitro antioxidant activity of dried *Ficus carica* from the cultivar “Bela Petrovka” is double that of fresh figs [36]. When compared to fresh fruits, dehydrated fig fruits have a higher nutritional density, higher fiber content, a longer shelf life, and a substantially higher phenolic content. The antioxidant qualities of processed dried fruits are the same as those of their fresh fruits. The in vivo antioxidant impact of ingesting a therapeutic intake of fig indicated that phenolics in dried fruit may be significant antioxidants [44]. It tends to be concluded by [42] that the antioxidant activity of crude methanolic extract of *F. racemosa* was additionally discovered as being excellent. The methanolic extracts of *F. racemosa* fruits possess substantial antioxidant properties, as well as antibacterial, thrombolytic, and cytotoxic properties that might be employed for the improved treatment of diseases.

3.2. Antimicrobial Activity. The phytochemical screening of fig fruit extracts revealed the presence of the same active components, notably flavonoids, tannins, and terpenoids. Each of these active chemicals has its unique mechanism, given the existence of substances with antibacterial action such as flavonoids, tannins, and terpenoids which have proven to have antimicrobial activity [56].

Mandal et al. [57] studied the antibacterial efficacy of the petroleum ether extract of *F. racemosa*. The results of the leaf on the bacteria *Bacillus pumilus* ATCC 14884, *Escherichia coli* ATCC 10536, *Bacillus pumilus* ATCC 14884, *Pseudomonas aeruginosa* ATCC 25619, and *Staphylococcus aureus* ATCC 4 are remarkably comparable with the standard. It can be inferred that the ether extract is composed of alkaloids, terpenes, coumarins, and fatty acids. The antibacterial sports are attributes of terpenoids, alkaloids; therefore, the *Ficus racemosa* has confirmed antibacterial pastime in all varieties of situations and might be actively included in ointments for infectious situations.

In vitro and in vivo tests have shown that an aqueous extract of figs reduces damage from bacterial pathogens.
(disease incidence and disease severity). The extract exhibits in vitro antibacterial activity against all bacterial strains used at various concentrations (106–108 CFU mL⁻¹). In vivo tests performed on fig extract confirmed the antibacterial activity of *Pseudomonas* [58]. Ethanolic and aqueous extracts of *Ficus religiosa* leaves confirmed antibacterial impact in opposition to *Shigella dysenteriae*, *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella paratyphi*, *S. typhimurium*, *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, and *Salmonella typhi*. The ethanolic extract of fig fruit confirmed an antifungal impact in opposition to *Candida albicans*. There are also antibacterial and antifungal activities from the aqueous, methanol, and chloroform extracts of *Ficus religiosa*. A huge spectrum of antibacterial pastimes with a 10–21 mm zone inhibition zone was possessed from the chloroform extract of *Ficus religiosa*. The methanolic extracts possessed a slight antibacterial activity in opposition to some bacterial strains. There is much less antibacterial activity or none in any respect for the usage of aqueous extracts. The extracts of *Ficus religiosa* had been discovered to be active in opposition to *Aspergillus niger* and *Penicillium notatum*. The extracts from the leaves exhibited tremendous and variable inhibitory effects in opposition to the maximum of the microorganisms tested [59].

The antibacterial potency of petroleum ether extract of *Ficus racemosa* Lin. leaves against bacteria *E. coli* ATCC 10536, *Bacillus pumilis* ATCC 14884, *Bacillus subtilis* ATCC 6633, *Pseudomonas aeruginosa* ATCC 25619, and *Staphylococcus aureus* ATCC 29737 were quite significant. The results were significantly comparable to standard chloramphenicol. It could be inferred that ether extract consists of alkaloids, terpenoids, coumarins, and fatty acids. The antibacterial activities that are attributes of terpenoids, alkaloids of *F. racemosa* Lin. has confirmed antibacterial activity in all sorts of conditions and can be actively incorporated into ointments for infectious conditions [60]. Antibacterial activity has been demonstrated in *Ficus hispida* extract. *Ficus hispida* leaf extracts in water, methanol, and ethyl acetate inhibit Gram-positive *Staphylococcus aureus* and Gram-negative *E. coli* with inhibition areas greater than 13 mm. The ethyl acetate extract was found to be more sensitive than the conventional antibiotics chloramphenicol (30 mcg/dis) and streptomycin (10 mcg/disc). *Ficus hispida* fruit suppresses Gram-positive *Staphylococcus aureus* and Gram-negative *E. coli* with inhibitory areas greater than 13 mm. The ethyl acetate extract was found to be more susceptible than the conventional antibiotics streptomycin (10 mcg/disc) and chloramphenicol (30 mcg/disc). When analyzed for antifungal efficacy against *Aspergillus niger*, the extract likewise demonstrated an inhibitory effect [51]. Wu et al. [61] discovered a significant relationship between the hydrophobicity and antibacterial activity for its action on Gram-negative bacteria membranes.

The compounds listed above could provide new leads for the development of pharmaceutically acceptable antibacterial agents. However, more research is needed to determine the mechanism of antibacterial action.

3.3. Antidiabetic Activity. Diabetes mellitus, characterized by hyperglycemia and insulin resistance, is occurring in a very important form, and is causing epidemic progress in many regions of the world [62]. The global prevalence of type 2 diabetes (T2D) is rapidly increasing, with a projected global prevalence of 552 million by 2030 [63]. Fruits and vegetables are both nutritional vital components of a healthy diet, and they are considered to have an important role in the prevention of T2D. Higher fruit intake -associated gut microbiota and metabolic changes were linked to a reduced incidence of T2D, lending credence to the public dietary guideline of eating more fruits for T2D prevention [64].

Fruit of figs has potential antiadibetic and anti-obesogenic effects as compared to the leaves and stem bark. Fig pulp may be used as an effective treatment to regulate abnormal carbohydrate metabolism associated with diabetes and hyperglycemia [65]. Tannins from *Ficus racemosa* were investigated for their ability to protect the lipid profile and antioxidant parameters in rats that were fed a high-fat diet and streptozotocin-induced hypercholesterolemia-associated diabetes. The *Ficus racemosa* tannin fraction successfully reversed the increased hyperglycemia, cholesterol levels, triglycerides, low-density lipoprotein, and significantly restored serum triglyceride levels. Furthermore, tannins significantly restored the activity of antioxidative enzymes peroxidase and catalase while decreasing glutathione peroxidase and glutathione, restoring the antioxidant state of the organs to normal levels [66]. The aqueous decoction of fig leaves has been shown to reduce total cholesterol and the total cholesterol/HDL cholesterol ratio, indicating that fig extract has a clear hypoglycemic effect. Because such an effect cannot be facilitated by steadily increasing insulin secretion, an undefined insulin-like peripheral effect may be recommended [67]. The addition of fig to the diet of insulin diabetes mellitus patients may aid in the control of postprandial glycaemia [68].

*Ficus religiosa* extract at 50 and 100 mg/kg showed significant reductions in blood glucose levels in normal glucose-loaded hyperglycemic and streptozotocin (STZ)-induced diabetic rats, and its effects were compared to glibenclamide, an established hypoglycemic medication. When a phytosterol isolated from *Ficus religiosa* root bark was administered orally to fasting rabbits at a dosage of 25 mg/kg, it generated a maximum drop in blood sugar level comparable to 81 percent of the tolbutamide stand after 4 hours [1].

Although several in vivo models have been successfully introduced to evaluate the antidiabetic effects of isolated compounds, due to the differences in the system, these compounds may not be effectively evaluated. There may be lower blood glucose levels in diabetic patients. Therefore, detailed studies of these active ingredients are still warranted to identify diabetes drugs that are more effective with mild or no side effects [69].

3.4. Anti-Inflammatory Activity. Inflammation usually develops when infectious microorganisms, such as bacteria or viruses, enter the body, are present in certain tissues, or
circulate through the blood [70]. Inflammation can develop in response to a variety of activities, including tissue injury, cell death, tumor, and ischemia degeneration. In most situations, both innate and adaptive immune responses contribute to inflammation development [71]. The 300 mg of ethanol extract and 600 mg/kg/day petroleum ether extracts of figs substantially exceeded carrageenan-induced rat paw edema \((P < 0.05)\). Ethanol and petrol have anti-inflammatory effects found in the hydroalcoholic extract of *Ficus carica*. This anti-inflammatory activity of the fig fruit could be due to the presence of steroids and phytochemicals. The phytochemicals showed the presence of anti-inflammatory effects in fig [72]. The anti-inflammatory activity of *Ficus racemosa* is studied by [57] in a model of rat hind leg edema induced by histamine, serotonin, dextran, and carrageenan. At the doses of 200 and 400 mg/kg, the extract showed anti-inflammatory activity. The effect produced by the extract is equivalent to that of phenylbutazone extract that show anti-inflammatory activity at doses of 200 and 400 mg/kg, and the results were found to be significantly equivalent to phenylbutazone, a prototype of a nonsteroidal anti-inflammatory agent and the ether extract show great anti-inflammatory effects as compared with standard drug indomethacin. The results show that the ethanol extract of the banyan tree showed more significant activity than petroleum ether in treating inflammation [73]. Various extracts (ethyl acetate, petroleum ether, ethanol, and chloroform) of *Ficus lacer* aerial root have significant anti-inflammatory activity comparable to standard drugs (indomethacin and pyrilamine) using carrageenan, histamine, and serotonin-induced paw edema in animal models. The ethanol extract \((100 \text{mg/kg})\) show significant anti-inflammatory activity of 75.40, 68.72, and 74.01% with carrageenan, serotonin, and histamine-induced paw edema, respectively [74].

**3.5. Hepatoprotective Activity.** The liver is the first major organ to be exposed to ingested toxins due to its portal blood supply and toxins may be, at least partially, cleared from the circulation during the first pass, protecting other organs while increasing the likelihood of hepatic damage [70]. With CCl4 administration, the methanolic and petroleum ether extract of *Ficus racemosa* stem bark induced a significant decrease in serum total protein, albumin, urea, and a significant increase in total bilirubin, as well as a marked increase in the activities of aspartate, aminotransferase, alanine, aminotransferase, and alkaline phosphatase. In nearly normal mice, pretreatment with petroleum ether extract and methanolic extract of *Ficus racemosa* resulted in significant recovery of total protein and albumin [75].

Channabasavaraj et al. [76] studied the hepatoprotective activity of methanolic extract evaluated in rats at doses of 250 and 500 mg/kg to prevent liver damage caused by carbon tetrachloride, with silymarin as a standard. Compared to control rats in serum, liver, and kidney treated with carbon tetrachloride, it showed that all biochemical parameters were significantly reversed. In acute toxicity tests, the methanol extract of the bark was shown to be safe up to 5,000 mg/kg body weight. As a result of its safety and powerful action, it is good to use this extract in the herbal preparations owing to its hepatoprotective and antioxidant qualities, as well as its active components that must be isolated. Methanol extracts of *Ficus hispida* leaves, given orally at 400 mg/kg, can prevent paracetaminduced hepatotoxicity by lowering blood levels of transaminase, bilirubin, and alkaline phosphatase. Histological profiles in paracetamol-treated mice revealed centrilobular necrosis in the liver, including infiltration of lymphocytes and Kupffer cells, fatty alterations, and ballooning degeneration. *Ficus hispida* leaves can help avoid paracetaminduced liver toxicity by decreasing bilirubin, transaminase, and alkaline phosphatase levels in the blood. Histological profiles of paracetamol-treated mice revealed centrilobular necrosis in the liver, including lymphocyte and Kupffer cell invasion, inflating degeneration, and fatty alterations. On the other hand, these effects were mitigated by *Ficus hispida* leaves extract [77]. Although the pharmacological antioxidative activity of these agents has indeed been evaluated in animal studies, additional research into the potential mechanism of hepatoprotective intervention is required.

**4. Health Benefits** *Ficus* species have been used in traditional medicine for a wide range of ailments in varied geographical locations. The health benefits of fig and its various bioactive compounds are listed below in Table 7 and Figure 1. *Ficus carica* fruits, when utilized properly, can serve as a source of flavonoids, dietary polyphenols, tocopherols, and ascorbic acids, all of which are good sources of antioxidants with a wide range of biological advantages, and thus their consumption should be stimulated [18]. *Ficus sycomorus* extract can offer scientific support for its traditional use for the treatment of sickle cell disease [34]. Figs have health-promoting potential due to their high phenolic content [84]. The latex of fresh fig could treat warts, toothache, hemorrhoids, cough, and be used externally or internally for cancer and other tumors treatment [33, 85].

The *Ficus benghalensis* plant has a high nutritional value and mineral content, indicating that it has therapeutic potential and extracts that may be utilized in pharmaceutical formulations. These plant seeds might be investigated as a feasible supplement and quick supply of dietary minerals in human meals to combat a variety of illness [17]. *Ficus carica* may be utilized as nutraceutical food with good nutrition and therapeutic benefits due to its high antioxidant potential [86].

The fruits of *Ficus sycomorus* are utilized as a significant medicinal herb and food which is employed to cure fungal infections, jaundice, and dysentery. Besides, it is appropriate for the treatment of cough, skin infections, stomach disorders, helminthiasis, liver disease, epilepsy, lactation disorders, *tuberculosis*, infertility, and sterility. Figs are a good source of calcium and potassium. These minerals can work together to improve bone density which presents osteoporosis [41]. Figs are fat-free, sodium-free, and like other plant
Foods cholesterol-free. Diabetes and high blood pressure can be treated with *Ficus pumila*, which works as herbal medicine and is also used for different kinds of beverages [51]. *Ficus racemosa* phytochemical screening revealed that the methanolic extract contains biologically active constituents such as saponins, phenols, tannins, saponins, flavonoids, phenols, flavonoids, and terpenoids with high medicinal value. The methanolic extract also seems to have cytotoxic activity and it might be a better treatment for tumors and cancer [42].

Crude extracts and phytochemical components from numerous *Ficus* species have been demonstrated in recent research to have antidiabetic effects in a range of in vitro and in vivo systems. The streptozotocin- and alloxan-induced diabetic mice compounds isolated from *Ficus* species substantially decreased all diabetes-related issues. Some of the most important antidiabetic actions of *Ficus* species have been shown to improve insulin sensitivity, stimulate insulin secretion, promote hepatic glycogen synthesis, reduce carbohydrate absorption, regulate enzymatic activity in the
intestinal tract, increase hepatic glucose production, and improve antioxidant capacity [87].

*Ficus religiosa* (Family; Moraceae) is utilized in the conventional system of medication for the treatment of various disorders. It is an herb that is determined in the old sacred writings of Homeopathy Siddha, Ayurveda, and Unani. Different parts of fig trees such as bark, root, leaf, fruits, and latex are appropriate for the treatment of different kinds of diseases such as astringent, diarrhea, diabetes, hemoptysis, carminative, vermifuge, and antisyphilitic. It is likewise utilized as a remedy for inordinate hunger. It is used topically to treat skin wounds, lymphadenitis, sprains, and fibrositis [1] Hence, this review provides a logical premise for additional investigations in relationship with the advancement of viable pharmacological drugs from the *Ficus* species.

5. Application in the Food Industry

Fig is extremely sweet, squishy, succulent, luscious, and fleshy, and the fruit paste used as a natural sweetener is a healthier option than corn syrup or sucrose. It can be made into delectable jams. Fig fruits can be prepared in various ways either peeled or unpeeled, relying on the cooking procedure. Puddings, cakes, fig pies, smoothies, milkshakes, custards, or other bakery products are easily prepared from fig. Fig fruits also can be used in frozen dessert mixtures. Home producers preserve entire fruit in syrup or prepare them as fig paste (with added wheat and corn flour, whey, syrup, oils, and other ingredients), jam, and marmalade, which are used as a tempting filling in different bakery products [88].

Due to the functional properties associated with these compounds, fig fruit coproducts are rich in polyphenolic compounds that may be reused by food enterprises as a distinguishing feature for the conception and formulation of functional foods [2]. Dried figs are accessible in various consumer and industrial products, including pasta, nuggets, powder, concentrate, and diced forms. Ice cream, yogurt, desserts, and porridge can all be topped with dried fig puree [84]. Fermented and unfermented different ranges of food products can be prepared by using fig fruit. In fermented food products, it can be utilized to produce wine and vinegar whereas, it tends to be utilized in its raw form or dried form in non-fermented food products [89].

6. Conclusion and Future Prospects

Fig is a primitive food that accompanies man from previous times. Either wild or cultivated, the different species of figs continue to provide nourishment to people around the world. *Ficus* species include a variety of bioactive substances with functional characteristics of industrial relevance, including carotenoids, phenolic compounds, flavonoids, vitamins, and antioxidant activity. The research has shown that fig fruit additionally reveals an extremely good composition of bioactive compounds. In vivo and in vitro experiments on human molecular strains together with the animal version the usage of fig fruit/leaves extract has proved its useful impact as anticancer, antidiabetic, antioxidant, antimicrobial, and anti-inflammatory. Based on the dietary bioactivities, this evaluation additionally highlighted the capacity utilization of fig fruit. The multidisciplinary research interventions have facilitated the conversion of underutilized fig fruit into healthy ingredients in the food sector. However, further research is needed to understand the biologically active molecular mechanisms of fig fruits. More exploration for the pharmacological activity and safety of certain fig compounds of fig fruit for food and plasma applications is required. Clinical trials of fig-based products on humans increase the potential of the food, pharmaceutical, and cosmetics industries. We strongly believe that the detailed information presented in this review of the various therapeutic effects of the constituents can provide detailed evidence of the use of the plant in various drugs. The fig fruits, if properly utilized, can be a potential source of bioactive compounds that are significant for human utilization and therefore their consumption should be stimulated. Figs establish a magnificent alternative as dried fruits or as food in several forms.

(i) Figs are underutilized crops, have a low shelf life, and are rich in nutrients; hence, by applying the food processing techniques they can be used for the preparation of many value-added products.

(ii) Figs also help in managing various skin conditions as it has a moisturizing effect which helps in reducing hyperpigmentation, acne, and wrinkles. It can help in making beauty products and figs can also be used for strengthening and improving hair quality.

(iii) Figs can be used as a staple ingredient in preparing smoothies, juices, and jams in the food industry.

Data Availability

All data pertaining to this work are provided in the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Supplementary Materials

Supplementary Graphical abstract: *Ficus* fruit species, extraction of bioactive compounds from *Ficus* fruit, health benefits associated *Ficus* fruit, and possible industrial applications of fig as a valuable source of functional ingredients. (Supplementary Materials)

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