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Phytochemical Content of Figs (Ficus carica L) and Their Therapeutic Effects as Anticancer and Antioxidant Agents

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ABSTRACT

Medical science is constantly searching for bioactive compounds derived from sustainable natural sources with therapeutic and preventive impact. The main goal of this article is to shine a light on the biological activities of fig (Ficus carica L.) extract and latex, as most studies focused on the health benefits of fig fruits. This work also aims to identify the potential of fig (either extracts or latex) in the treatment or prevention of various diseases. Especially since fig latex or extract has numerous biological activities, such as antidiabetic, antioxidant, and anticancer properties.

Key words: fig latex, fig extracts, biological activity, anti-cancer activity, antioxidants

INTRODUCTION

The deciduous fig tree (Ficus carica L.) is one of the first trees intentionally cultivated by humans. These trees belong to the Moraceae family, also known as the mulberry family or fig family [1]. And are native to southwest Asia, often grown in the Mediterranean region [2]. The latex of fig is rich in biologically active phytochemical compounds such as polyphenols, carotenoids, glycosides, terpenoids, flavonoids, phenolic acids, polysaccharides, and vitamins E, K, and C, in addition to trace elements [3]. The latex of fig is a great source of minerals, vitamins, and phenolic compounds [4]. F. carica secretes a milky sap (latex) from various parts of the plant. Such as its stems, fruits, and seeds, this sap contains various secondary metabolites, like alkaloids, organic acids, fatty acids, sterols, enzymes, amino acids, and tannins [7]. These diverse metabolites are responsible for the biological properties of latex extract (such as cytotoxic, antioxidant, and wound-healing effects) [8]. The primary function of this juice is to

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protect plants from external factors and promote self-healing; therefore, it is often secreted in large quantities [11]. The essential component of focus latex is the cysteine endopeptidase enzyme (Ficin (EC:3.4.22.3)), which is involved in regulating, triggering, and executing all sorts of physiological and biological processes [9]. In traditional medicine, fig milk was used to treat many diseases, like anemia, cancer, diabetes, liver diseases, leprosy, dermatologic diseases, and paralysis [10]. Belguith et al concluded that the fig extracts were used to treat hyperglycemia, hyperlipidemia, and reduced diabetes [11]. In another study conducted on the mice by Tantowi et al, it was found that fig extracts are used to prevent osteoporosis. Latex is a natural adhesive like polymer found in many parts of plants, including their vascular system [12]. All types of figs contain a latex found in the plant's vascular system, which protects the plant from natural external factors [12]. In addition to fig tree latex, it has shown a positive effect in medicinal applications, such as wound healing and wart treatment [13]. The metabolites that make up fig tree latex are diverse, such as terpenoids, phenols, etc. This diversity is responsible for the diversity of biological activities of this latex such as antiviral, antifungal, antibacterial, antioxidant, antiflammatory, anti-cancer, antihypertensive, and antiparasitic properties [14].

Polyphenols

Phenols play a major role in neutralizing free radicals and protecting cellular components, organs, and tissues from peroxides resulting from the breakdown of lipids containing unsaturated fatty acids [15]. Phenolic compounds are abundant in all types of figs; in addition, these plants contain numerous antioxidants and may be beneficial to human health [16]. Where polyphenols are beneficial in treating or preventing neurodegenerative diseases [17], cardiovascular diseases [16], weight management problems [18], diabetes [18]. Phenols are plant secondary metabolites that act as antioxidants by scavenging free radicals, quenching singlet hydrogen atoms, and donating a hydrogen atom [19]. Fig trees are good source of phenolic compounds [20], however, the phenolic content of figs varies greatly from one variety to another [21]. That these biologically active components can be successfully absorbed from the digestive tract into the blood and transported to the appropriate place in the body while maintaining their vital activity [22]. Biologically active compounds can be extracted from fig latex such as 6-O-acyl-p-D-glucosyl-psitosterol or AGS (acyl methyl group: palmitoyl, linoleyl, stearyl, and oleyl) [23]. The palmitoyl derivative of AGS is considered the most effective inhibitor of various cancer cell lines. Compared to other derivatives such as stearyl, oleyl, and linoleyl [24]. A laboratory study has proven that AGS is the most effective compound in treating cancer. The results showed that this compound inhibits the growth of cancer cell lines [25].

Polyunsaturated fatty acids

Polyunsaturated, saturated, and monounsaturated fats are known to reduce the risk of heart disease, so consuming these types of fats is recommended [26]. Omega-3- fatty acids (40.25%), and Omega-6- fatty acids (31.28%) are two major subgroups of polysatureated fatty acids [27].

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These two types of fats are essential for human health [28], as they are required for the development of cells and the function of the brain. Especially since the human body cannot produce vital fatty acids, in addition to the biochemical elements found in figs, there are many studies that have shown that phytosterols are also present in the figs [28].

Vitamins

Nutrients are classified into two main categories: (i) micronutrients, which the body needs in tiny quantities, and (ii) macronutrients, which the body needs in large quantities [29]. Minerals and vitamins fall under the category of micronutrients as they contribute the development of the skeleton and metabolic processes [30]. Figs contain high levels of vitamins and minerals. Vitamin C is a water-soluble vitamin and a powerful natural antioxidant found in figs that reduces non-enzymatic oxidation in fruit and vegetables [31]. Figs are considered one of the healthiest fruits and are associated with longevity [32].

Antioxidants

Antioxidants are compounds that prevent the formation of reactive oxygen species [33]. Fig extracts contain bioactive substances such as carotenoids, polyphenols, and flavonoids, all of which have antioxidant properties [34]. Fig extracts contain several phytochemical compounds that have therapeutic activity, like anticancer properties and antifungal and anti- inflammatory activity [35]. Fig extracts are considered to be among the largest natural antioxidants due to varying numbers of these antioxidants [33]. A study showed that dried figs act as an antioxidant after being eaten by humans [35]. As it was found that the figs are rich in phenols and fiber, which have a positive impact on human health. These antioxidants work by (i) scavenging free radicals and reducing hydrogen and (ii) quenching singlet oxygen [36]. In addition to its antioxidant effects, fig extracts have antitumor, anticancer, anti-inflammatory, and antibacterial properties [37]. A study has shown that high concentrations of polyphenols in fig extracts lead to increased antioxidant activity [38]. The results showed that the antioxidants of fig extracts significantly increase the antioxidant capacity of plasma and also protect the phospholipids in plasma from oxidation [35].

Skin disease treatment

The skin is one of the largest organs in the body, as it protects the rest of the body's organs from external effects [39]. According to studies, there are many plants used to treat skin diseases like warts and eczema [40]. Such plants are the figs that were studied by Tabassum and Hamdani [41], where the study concluded that figs can be used to treat pimples, warts, and itching on the skin [42]. Another study by [43] showed that white fig latex contains enzymes that treat cauterization of warts. By[44], also reached the same results in their study. And indicated in their study that various extracts of figs can be used to treat warts. In addition. [45] that fig

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extract is considered an effective treatment for getting rid of the symptoms of eczema, which is one of the common skin diseases characterized by the appearance of blisters, redness, and itching on skin.

Cancer

Cancer is a well-known and common disease around the world. Many studies have been conducted to reduce the incidence of cancer [41], and some of these studies have focused on the use of fig latex to reduce the incidence of cancer [34]. Ganbari et al. accomplished a scientific study to examine in vitro the biological activity of fig latex; the study indicated that figs are effective in treating cervical cancer [46]. Another study was conducted by [47] on fig juice and showed that fig juice contains antioxidants that are essential for cancer treatment [23]. Lansky et al. concluded in their study that fig latex has a positive impact against cancer due to its and cancer anti-inflammatory properties [48].

Diabetes

Nowadays, diabetes is one of the most common endocrine diseases; it is a disorder characterized by an imbalance in the metabolism of carbohydrates and fats, which leads to high blood sugar levels [49]. The incidence of diabetes is constantly increasing, and the most widely used therapeutic intervention for this disease is synthetic antidiabetic drugs [22]. But it is always preferable to use pharmaceutical preparations derived from natural materials compared to those synthetic drugs [22]. In this regard, many plants have been shown to have anti-diabetic effects. Among those plants is the fig. The extracts of fig demonstrate antidiabetic activity through two mechanisms [23]:

(i) Inhibiting the α-amylase and α-glucosidase enzymes, thus reducing absorption of sugar in the intestinal tract.
(ii) enhance glucose uptake through glucose transporter type 4 (GLUT4), phosphatidylinositol 3 (PI3K), serine/threonine protein kinase, and
(iii) Regulating glucose homeostasis through activation of protein kinase (APK).

Irudayaj et al. reported that ficus extracted from fig leaves is effective in treating type 2 diabetes [49]. Perez et al. stated in another study that the extracts of Ficus carica are useful for controlling diabetes syndrome due to their antioxidant content [50].Chatterjee et al. found that figs contain abundant potassium, which reduces the amount of sugar in blood [51]. This effect is attributed to the flavonoids [52].

Cardioprotection

The term “cardioprotection” refers to all mechanisms that prevent of myocardial damage [12]. This is definition can be including all cardiovascular diseases and other factors such as hypertension and diabetes...etc [41]. There are many plants such as figs that appear its potential as anti-hypertensive agents [16]. Methanolic Extract from fig fruits decreased levels of blood

pressure in rats, and in vitro experiments: a reduced of the contraction force and heart rate [24]. These impact are antioxidant properties of its phenolic compounds in fruits of fig extraction[53].

Weight loss

Vinson et al. measured the phenolic compounds in dried figs and found that dried figs contain a large number of phenolic antioxidants. Therefore, a large amount of figs is recommended in the diet [54].

Constipation

Constipation is defined as fewer than three bowel movements per week [55]. Constipation is a highly prevalent issue; it's affected by a number of psychological, social, and behavioral factors such as low calorie intake, lack of movement, and changes in anorectal sensation [56]. In addition, there are other factors like comorbidities and side effects of medications such as anticonvulsants, medications for cancer, antidepressants, and pain relievers [57]. According to Greek medicine, figs are used to treat dysentery, constipation, hemorrhoids, and intestinal inflammation. In addition, it can treat ringworm and leukoderma [58].

CONCLUSIONS

The active molecules found in the fig latex are well known to have therapeutic properties, like antibacterial, antiviral, anti-inflammatory, antioxidant, and anticancer effects. These properties are attributed to the presence of numerous chemicals in fig latex, such as Polyphenols, polyunsaturated fatty acids, and vitamins. These compounds have anti-diabetic, antioxidant, and anticancer properties.

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Conflict of interests

There are non-conflicts of interest.

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تكون العلوم الطبية في حال بحث مستمر عن مركبات فعالة حيويا مشتقة من مصادر طبيعية مستدامة ذات تاثيرات وقائية وعلاجية. الهدف الرئيسي لهذا البحث هو تسليط الضوء على مستخلص او حليب التين خصوصا وان اغلب البحوث تركز بشكل كبير على الفوائد الصحية لثمار التين, كما يهدف هذا العمل ايضا الى التعرف على امكانية التين (سواء كانت مستخلصات او حليب) في معالجة او منع مختلف الامراض خصوصا وان مستخلص اوحليب التين يمتلك العديد من الفعاليات الحيوية مثل مضاد السكري, مضادات اكسدة, حماية الكبد, وخواص مضادة للسرطان.

الكلمات المفتاحية: حليب التين, مستخلصات التين, الفعالية الحيوية, مضاد سرطان. مضادات اكسدة.

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