



# Phytotherapy in Liver Diseases

## Karaciğer Hastalıklarında Fitoterapi

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### ABSTRACT

The liver is the largest internal organ in the body and has vital functions such as metabolism, elimination of toxins, and bile production. Liver diseases include various conditions that affect the functions of this organ. The most common liver diseases include hepatitis, cirrhosis, fatty liver disease, and liver cancer. These diseases can develop due to genetic factors, alcohol consumption, viral infections, and obesity. A healthy lifestyle is of great importance in preventing liver diseases. Measures such as a balanced diet, regular exercise, limiting alcohol consumption, and protection from viral infections (e.g., vaccinations) help protect liver health. In addition, avoiding exposure to toxins is also important. Interest in phytotherapy has increased considerably in recent years, except for medical applications, in the protection of liver health and the treatment of liver diseases. Among the plants used for this purpose, foods such as artichoke, pomegranate, grapes, and grapefruit, teas such as chamomile, or extracts containing active ingredients such as ellagic acid, resveratrol, and curcumin can be listed. This article will discuss the effects of some plants on liver health. In addition to the plants mentioned here, many other plants are used in this area. While plants are beneficial when used in food format for general health, if they are used for treatment purposes and as an extract, they should be used under the supervision of a physician who has received phytotherapy training. As a result, liver diseases can be prevented, and when they do occur, most of them can be treated. A healthy lifestyle, regulating habits, healthy choices in food intake, and herbal supplements can play an important role in this process.

**Keywords:** Liver, liver diseases, phytotherapy, herbal treatment, hepatitis

### ÖZ

Karaciğer, vücudun en büyük iç organıdır ve metabolizma, toksinlerin atılması, safra üretimi gibi hayati işlevleri vardır. Karaciğer hastalıkları, bu organın işlevlerini etkileyen çeşitli durumları içermektedir. En yaygın karaciğer hastalıkları arasında hepatit, siroz, yağlı karaciğer hastalığı ve karaciğer kanseri bulunmaktadır. Bu hastalıklar, genetik faktörler, alkol tüketimi, viral enfeksiyonlar ve obezite gibi nedenlerle gelişebilmektedir. Karaciğer hastalıklarının önlenmesinde sağlıklı yaşam tarzı büyük önem taşımaktadır. Dengeli beslenme, düzenli egzersiz, alkol tüketiminin sınırlandırılması ve viral enfeksiyonlardan korunma (örn., aşılar) gibi önlemler, karaciğer sağlığını korumaya yardımcı olmaktadır. Ayrıca, toksinlere maruziyetten kaçınmak da önem arz etmektedir. Karaciğer sağlığının önlenmesi ve tedavisinde medikal uygulamalar hariç son yıllarda fitoterapiye olan ilgi oldukça artmıştır. Bu amaçla kullanılan bitkiler arasında; enginar, nar, üzüm ve greyfurt gibi besinler, papatya gibi çaylar ya da ellajik asit, resveratrol ve curcumin gibi etken maddeleri içeren ekstre şeklinde kullanılabilir. Bu yazıda, bazı bitkilerin karaciğer sağlığı üzerindeki etkilerinden bahsedilecektir. Bu alanda burada adı geçen bitkilerin dışında da çok sayıda bitki kullanılmaktadır. Bitkiler genel sağlık için gıda formatında kullanıldığında faydalı olurken tedavi amaçlı ve ekstre olarak kullanılacaksa fitoterapi eğitimi almış bir hekim gözetiminde kullanılması gerekmektedir. Sonuç olarak, karaciğer hastalıkları önenebilir, hastalık oluştuğunda ise çoğu tedavi edilebilir. Bu süreçte sağlıklı yaşam tarzı, alışkanlıkları düzenlenmesi, gıda alımında sağlıklı seçimler ve bitkisel destekler önemli bir rol oynayabilir.

**Anahtar Kelimeler:** Karaciğer, karaciğer hastalıkları, fitoterapi, bitkisel tedavi, hepatitis

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**Received:** 25.10.2024  
**Accepted:** 30.10.2024

**Cite this article as:** Akçakaya A. Phytotherapy in Liver Diseases. Bezmialem Science. 2024;12(4):491-7



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## Introduction

The liver is a critical center for many physiological processes, weighing approximately 1200-1500 grams, making up 2-3% of the total body weight, making it our heaviest internal organ. This organ, which plays an important role in areas such as metabolism, detoxification, digestion and the immune system, is one of the cornerstones of our health. However, diseases develop in the liver due to various factors. Alcohol consumption, viral infections, obesity and genetic factors are among the causes that threaten liver health.

The gallbladder and bile ducts are among the important structures that support the functions of the liver. While the liver plays a role in bile production, the gallbladder stores this fluid and releases it when necessary during the digestive process. The bile ducts, on the other hand, ensure that bile is transported from the liver to the intestines. Any disorder that may occur in this complex system can affect digestive health and lead to various diseases.

Liver diseases can be listed as hepatitis (viral, alcoholic or toxic hepatitis), fatty liver disease (hepatic steatosis), cirrhosis, liver fibrosis, liver cancer (hepatocellular carcinoma), hemochromatosis, Wilson's disease, cholestasis, and drug-induced hepatotoxicity.

## 1. Liver Diseases

### 1.1. Hepatitis

#### 1.1.1. Viral Hepatitis

It is an inflammation of the liver caused by infection with hepatitis viruses (A, B, C, D, E). Each virus can be transmitted in different ways and can cause acute or chronic hepatitis. Among viral hepatitis, hepatitis B and C in particular have the potential to become chronic and can lead to cirrhosis or liver cancer.

#### 1.1.2. Alcoholic Hepatitis

It is characterized by inflammation and damage to liver cells due to long-term and excessive alcohol consumption. Alcoholic hepatitis can progress to liver cirrhosis and liver failure, while symptoms such as jaundice, abdominal pain and fever can be seen in the clinical picture.

#### 1.1.3. Toxic Hepatitis

It is an inflammation of the liver caused by drugs, chemicals, toxins or overdosage of some herbal products. Toxic hepatitis can be acute or chronic, depending on the type and dose of the substance taken. Some commonly used painkillers, such as acetaminophen, can also cause toxic hepatitis (1).

### 1.2. Fatty Liver Disease (Hepatic Steatosis)

It means that the liver contains at least 5% more fat than its own weight. This condition clinically presents itself in two forms: alcohol-related hepatosteatosis and non-alcoholic hepatosteatosis, which we encounter more frequently. Non-alcoholic fatty liver disease (NAFLD) can be seen in all age groups and ethnic groups. Its incidence in the general population is around 14-30%.

Basically, any condition accompanied by insulin resistance is a risk factor for non-alcoholic hepatosteatosis. Fatty liver disease is more common in men than in women, and it has been reported that its incidence is related to the waist/hip ratio, independent of body weight (2).

### 1.3. Cirrhosis

Cirrhosis, also known as chronic liver disease, is the occurrence of damage to the liver at different levels due to various causes. The liver damage caused by cirrhosis is usually irreversible, but if diagnosed early, the damage can be limited. Although cirrhosis does not show symptoms in the early stages, it occurs with severe symptoms as the disease progresses (3).

### 1.4. Liver Fibrosis

Liver fibrosis is defined as the excessive accumulation of extracellular matrix components that occur as a result of the wound response following chronic injury. Fibrosis initially takes part in the tissue repair mechanism but later becomes pathogenic (4).

### 1.5. Liver Cancer (Hepatocellular Carcinoma)

It ranks 5<sup>th</sup> in the world in terms of incidence, and in our country, it most commonly occurs as a result of hepatitis B infection. It is seen 3 times more frequently in men than in women, and the incidence in men is 15 per 100,000 people each year. Of liver cancers 90% develop on the basis of cirrhosis. Liver cancer development rates vary depending on the cause of cirrhosis (5).

### 1.6. Hemochromatosis

It occurs when iron is absorbed more than necessary and accumulates in excessive amounts in the body. This disease is hereditary and shows an autosomal recessive pattern. Excessive iron accumulation leads to serious health problems such as liver cirrhosis, heart failure, diabetes and joint pain. In the early stages of the disease, symptoms such as fatigue, abdominal pain and tanning of the skin may be observed, but the symptoms usually become apparent in the advanced stages (6).

### 1.7. Wilson Disease (Copper Metabolism Disorder)

It is an autosomal recessive genetic disease that causes copper to accumulate in the liver, brain and other organs as a result of the body's inability to regulate copper metabolism. Its symptoms include liver disease, neurological disorders and Kaiser-Fleischer ring formation in the eye. Treatment is with drugs that prevent copper accumulation and early diagnosis is important for treatment (7).

### 1.8. Drug-induced Liver Damage (Hepatotoxicity)

It refers to the damage to the liver by drugs or other chemicals. Hepatotoxicity can result in inflammation, damage or necrosis of liver cells and usually varies depending on the dose, duration and individual sensitivity to the drugs. Symptoms may include jaundice, abdominal pain, nausea, vomiting and elevated liver enzymes. Early diagnosis and treatment are critical to preventing and reversing liver damage (8). Despite major advances in

modern medicine, there are no completely effective drugs that stimulate liver function, protect the organ or help regenerate liver cells. In addition, some drugs may cause adverse or side effects. Therefore, alternative methods need to be determined for the treatment of liver diseases. The aims of these alternatives are to be more effective and less toxic. Phytotherapy in liver diseases aims to support liver function, improve detoxification processes and reduce inflammation. The benefits of this traditional medicine with a long history are also revealed by scientific studies.

## 2. Plants Used in Liver Diseases

### 2.1. Grapefruit

Latin name: *Citrus paradisi*

Active ingredient: *Naringin and Naringenin*

Grapefruit juice contains many phytochemicals and nutrients important for a healthy diet. It is used in traditional medicine in many countries due to its antimicrobial, antifungal, anti-inflammatory, antioxidant and antiviral properties. In addition to nutrients such as vitamin C, folic acid, potassium, calcium, iron and various phenolic acids, it is also rich in limonoids, terpenes and D-glucaric acid. The red and pink varieties contain antioxidants such as beta-carotene and lycopene. One of its most important compounds is the flavonoid naringin, which is metabolized into naringenin in the human body. Grapefruit has antioxidant, anti-inflammatory and choleric features, supports detoxification, and reduces fat in liver diseases. Among the scientific studies conducted to observe its effects, the potential role of grapefruit juice in relieving itching (pruritus) due to cholestatic liver disease was examined in the study by Cadranet et al. (9). The study observed that grapefruit juice could reduce itching caused by this disease. Researchers suggest that the compounds in grapefruit juice can relieve pruritus symptoms due to their effects on improving liver function (9). The study by Nahmias et al. (10) provides an important finding for liver diseases with the ability of naringenin to inhibit the secretion of hepatitis C virus (HCV). Hepatitis C can cause chronic inflammation in the liver, leading to cirrhosis, liver failure and liver cancer. Naringenin has been found to inhibit the secretion of HCV from liver cells in an apolipoprotein B-dependent manner. This flavonoid can limit viral replication in liver cells by reducing the viral load, thus slowing down the progression of the disease. This study shows that the grapefruit compound naringenin may be a potential adjuvant in the treatment of liver diseases and may provide a new perspective on antiviral treatments (10). Although it is known for its liver health-supporting effects, dosage and safety issues should be taken into consideration when consuming this fruit. It should not be forgotten that grapefruit can interact with some drugs and therefore should be used with caution. In particular, it slows down the breakdown of some drugs by inhibiting the CYP3A4 enzyme found in the liver, which can cause an increase in the blood levels of some drugs. As a result, the effects of the drugs may be strengthened and side effects may occur. While grapefruit juice may cause heartburn or digestive problems in some people, allergic reactions to grapefruit may

be seen, although rare. In addition to these conditions, it is recommended that those with low blood pressure and liver enzyme problems consume it carefully. In general, 1/2 to 1 fresh grapefruit or a glass of grapefruit juice per day is usually sufficient.

### 2.2. Grape

Latin name: *Vitis vinifera L.*

Active ingredient: *Catechins, epicatechins, anthocyanidins, proanthocyanidins and resveratrol*

Various preparations used in popular and traditional medicine have been obtained from different parts of this plant, especially its fruit. These preparations stand out with their diuretic, anti-inflammatory and cholesterol-lowering effects, as well as their cancer-preventive activities against cardiovascular diseases and some cancers (especially prostate and colon cancer). The mechanisms of action of grapes are to protect the liver and its enzymes and to show antioxidant properties.

In a study conducted by Khoshbaten et al. (11) to investigate its effects on liver functions, the effect of grape seed extract on liver functions in patients with NAFLD was evaluated. The 50 patients who participated in the study were divided into two groups; one group received grape seed extract and the other group received placebo. After three months of treatment, the levels of liver enzymes (alanine aminotransferase and aspartate aminotransferase) significantly decreased in the group receiving grape seed extract. The study concluded that grape seed extract could improve liver functions in patients with NAFLD (11).

In the study by BedÊ et al. (12), the effects of grape juice, red wine and resveratrol on liver parameters in rats on a high-fat diet were examined. The rats were divided into four groups and received different treatments: grape juice, red wine, resveratrol and the control group. At the end of the study, improvements were observed in parameters indicating liver damage in the groups given grape juice, red wine and resveratrol. In particular, the effect of resveratrol in reducing liver steatosis was noted. As a result, it was found that these components might have mitigating effects on liver damage caused by a high-fat diet (12).

It is rare for grapes to interact with some medications, but it should not be forgotten that wine consumption may interact with some medications. Since it naturally contains high sugar, people with low sugar or glucose tolerance should consume it with caution. Caution should be exercised in its use as it can cause allergic reactions, increase the risk of bleeding, change the levels of liver enzymes and cause stomach and digestive problems. It is generally recommended to consume 1-2 servings of fresh grapes. One serving is approximately composed of 150-200 grams of grapes. This amount can provide sufficient amounts of antioxidants and other nutritional components. Grape seed extract can usually be used as a supplement in doses between 100-300 mg. These dosages are generally recommended ranges in clinical studies and health supplement products.

### 2.3. Daisy

Latin name: *Matricaria chamomilla* or *chamomilla recutita*

Active ingredients: *Apigenin, bisabolol, chamazulene, flavonoids, caffeic acid*

Chamomile is an Asteraceae plant native to Europe and is widely found throughout the world except for tropical and polar regions. This plant has been used for its therapeutic properties since ancient Egyptian and Greek civilizations. Pharmacological activities of various components of the plant, such as the modulatory effects and anti-inflammatory capacity of the flavonoids apigenin and quercetin on Hsp, and anti-inflammatory, antioxidant and antiseptic activities detected in  $\alpha$ -bisabolol, guargazulene and chamazulene, have been reported. It has antioxidant, anti-inflammatory, hepatoprotective, bile flow regulator, anti-fibrotic, spasmolytic effects and is effective through sedative pathways. Saadh (13) discusses the potential benefits of chamomile for liver health in his article. Due to its anti-inflammatory and antioxidant properties, chamomile helps protect liver cells from damage caused by toxins or oxidative stress, and also it contributes to the improvement of liver functions. In traditional herbal medicine, chamomile is used to reduce inflammation and improve digestion, which plays a supportive role in the management of liver-related disorders (13). Rajaratnam et al. (14) discussed the role of chamomile in the treatment and prevention of liver diseases in their article. Chamomile exhibits protective properties for liver cells with its anti-inflammatory and antioxidant effects and helps reduce cellular damage in liver diseases, especially by providing protection against toxins and oxidative stress. In addition, it supports liver functions with its digestive regulating effects and contributes to the overall healing process. Chamomile, which is frequently used in traditional herbal treatment practices, is emphasized as an important plant for liver health.

Since side effects such as allergic reactions, risk of bleeding, and sedative effects may occur, it should be used with caution in these cases and under the supervision of a doctor during pregnancy and breastfeeding. It is usually consumed in tea or extract form. It is generally recommended to consume 1-2 cups of chamomile tea daily or extract at the dosage specified on the product labels.

### 2.4. Thistle

Latin name: *Silybum marianum* L.

Active ingredient: *Silymarin*

It is the most researched plant throughout human history. The oldest form of use of the plant is the treatment of snake bites recommended by Dioscorides. Gaius Plinius (23-79 AD) suggested that the plant mixed with honey should be used for bile excretion. Later, in the Middle Ages, it was accepted and used as an antidote for liver toxins. Today, the recommended use by the German Commission E is for toxin-induced liver damage, dyspeptic complaints including cirrhosis, and liver disorders.

The mechanisms of action of thistle in liver disorders are through its anti-inflammatory, immunomodulatory, hepatoprotective, anti-fibrotic, antioxidant properties.

In studies conducted on these properties of thistle, Eren and Şar (15) emphasized the protective and healing effects of the virgin thistle plant, especially in liver diseases. The silymarin compound found in the plant protects the liver from toxins, supports cell renewal and is used in the treatment of liver diseases such as cirrhosis and hepatitis (15). In Turgut's (16) study, the peroxidase enzyme of the thistle (*Silybum marianum*) plant grown in the Sakarya region was characterized. The study examines the biochemical properties of the peroxidase enzyme isolated from this plant and provides a basis supporting the positive effects of the plant on liver health (16). Nausea, abdominal distension and a mild laxative effect may be observed when using this plant. It is contraindicated in those allergic to the daisy family (*Astereceae*) and in pregnant and breastfeeding mothers. The recommended use is 12-15 g of drug/day (200-400 mg of silymarin) or 400-1100 mg of standard extract/day.

### 2.5. Pomegranate

Latin name: *Punica granatum*

Active ingredient: *Punicalagin and punicic acid*

Pomegranate has strong antioxidant properties and supports mitochondrial functions by reducing oxidative stress in cells. This improves the energy metabolism of liver cells and prevents fat accumulation. The components of pomegranate play an effective role in protecting liver health and preventing mitochondrial dysfunction.

As a result, pomegranate can be defined as an important fruit in the fight against obesity-related liver diseases due to its rich antioxidant content and the protective effects of punicalagin.

In addition to its antioxidant properties, pomegranate has anti-inflammatory properties and plays a role in improving mitochondrial functions, regulating fat metabolism and adjusting cellular energy metabolism.

In the study by Çalışkan et al. (17), the protective effect of pomegranate juice against acute liver toxicity caused by paracetamol in rats was investigated. The study examined the effect of pomegranate juice in reducing liver damage in rats given high doses of paracetamol, which caused liver toxicity. The results showed that pomegranate juice reduced liver damage, improved liver enzyme levels, and reduced oxidative stress due to its powerful antioxidant properties. The study highlights that pomegranate juice may play a potential protective role against paracetamol-induced liver toxicity (17). Zou et al. (18) investigated the role of mitochondrial dysfunction in obesity-related NAFLD and the protective effects of punicalagin, the active ingredient of pomegranate. The study showed that obesity-induced liver damage was associated with mitochondrial dysfunction and was associated with oxidative stress. Punicalagin, the active ingredient of pomegranate, helped prevent the deterioration of mitochondrial functions, reduced oxidative stress, and prevented fat accumulation in the liver. Punicalagin also supported cellular energy metabolism and strengthened antioxidant defense mechanisms. The study concluded that punicalagin provided a strong protective effect against NAFLD and had the potential



to improve mitochondrial health (18). The recommended dose is 3-9 g/day for powder obtained from the root, stem and bark (5% brewing).

## 2.6. Artichoke

Latin name: *Cynara scolymus*

Active ingredient: *Sinarin*

*Cynara scolymus* (artichoke) has been consumed as a food in the Mediterranean diet and worldwide for many years. It is used in traditional treatment, especially in the treatment of many diseases, especially liver and gallbladder disorders. In Commission E monographs, the leaves of the plant (*Cynarae folium*) are recommended in the treatment of digestive system complaints and liver and gallbladder disorders.

In addition, artichoke leaf extracts are used to eliminate digestive problems and lower blood cholesterol levels. We can list the mechanisms of action of artichoke as antioxidant activity, its effectiveness on serum lipid and lipid peroxidation, choleric effect and hepatoprotective properties. Among the studies conducted on the mechanisms of action of artichoke, the therapeutic effects of milk thistle (*Silybum marianum*) and artichoke (*Cynara scolymus*) plants on NAFLD in rats with type 2 diabetes were investigated in the study by Doostkam et al. (19). The potential of these plants to improve liver health was evaluated in the study and it was found that both plants showed antioxidant, anti-inflammatory and fat metabolism regulating effects. Milk thistle improved enzyme levels in the liver, while artichoke was found to help reduce fat accumulation. The results suggest that milk thistle and artichoke may be effective natural treatment options in the management of NAFLD in individuals with type 2 diabetes (19). Panahi et al. (20) studied the effectiveness of artichoke leaf extract on NAFLD. The study was conducted as a pilot double-blind randomized controlled trial. The study evaluated whether artichoke leaf extract improved liver enzyme levels, lipid profiles, and overall liver health in individuals with NAFLD. The results showed that artichoke leaf extract significantly lowered liver enzymes and improved lipid metabolism. The study findings suggest that artichoke leaf extract may be a potential natural treatment option for the treatment of NAFLD (20). Although larger-scale studies are needed, these results support the positive effects of artichoke on liver health, and suggest that the mechanisms of these plants that support liver health may play an important role in the treatment of metabolic disorders. When consuming artichoke, those with allergies should not use it, those with gallbladder problems should consult a physician, and breastfeeding mothers should be careful. The recommended amounts to consume are 5-10 grams of tea made from the base leaves once a day, and 6 mL of 40% concentration per day is predicted to be sufficient for use as a tincture.

## 2.7. Ellagic Acid

Ellagic acid (EA) is a natural polyphenol found mainly in condensed form in nature as ellagitannins. It is found in many fruits (e.g., pomegranates, raspberries, cloudberries, wild

strawberries, blackberries), some nuts (e.g., walnuts, almonds, pecans), various seeds (e.g., nut seeds), vegetables (e.g., radishes), and many medicinal plant species. EA has attracted attention in recent years due to its wide range of biological effects and potential health benefits. It is known for its strong antioxidant properties, anti-inflammatory effects, and antimicrobial and antimutagenic effects. In addition, many studies have reported cardioprotective, neuroprotective, gastroprotective, hepatoprotective, and nephroprotective effects of EA. Moreover, numerous studies indicate that EA has properties that can inhibit cell proliferation and potentially prevent cancer development. EA has antioxidant, anti-hepatotoxic, anti-steatosis, anti-cholestasis, anti-fibrogenic, anti-hepatocarcinogenic and anti-viral properties and supports the structural and functional recovery of the liver against toxic and pathological conditions. As a result of the study conducted by Devipriya et al. (21), it was stated that EA inhibited alcohol-induced liver cell damage, increased antioxidant levels, scavenged free radicals and stabilized cell membranes. This study showed that EA-treated female albino Wistar rats against alcohol-induced damage improved body weight, restored antioxidant status, modulated micronutrients and inhibited alcohol-induced toxicity by reducing circulating lipid levels (21). The administration of EA effectively reduced circulating lipid levels and prevented lipid peroxidation. This was reported by Derosa et al. (22), who confirmed that EA supplementation reduced plasma cholesterol elevations in hyperlipidemic rabbits. It has been stated that EA may reduce the activity of 3-hydroxy-3-methylglutaryl coenzyme A (HMG CoA) reductase or may reduce other lipid levels by increasing hepatic bile acids and neutral sterol in the stool by increasing the speed of the lipid breakdown process (22). There is no specific dosage range for EA to show its protective and therapeutic effects on liver diseases. However, some studies have shown that 30-60 mg of EA per day may be beneficial. However, the effects of EA may vary from person to person and it is important to consult a doctor before use. In addition, consuming foods containing EA (e.g., pomegranate, blackberry and blackcurrant) may also be a natural way. In any case, it is best to get a professional opinion on treatment and dosage.

## 2.8. Olive Leaf

Latin name: *Olea europaea L.*

Active ingredient: *Oleuropein*

The leaves of the olive tree have been widely used in traditional medicines in Mediterranean countries. Olive leaf extract (OLE) contains high amounts of the phenolic antioxidant oleuropein, which is significantly higher than those found in olive fruit or olive oil. The properties of olive leaves include antioxidant, inflammation reduction, fat metabolism regulation and detoxification mechanisms of action.

OLE has shown protective effects against methotrexate-induced hepatotoxicity and chemically induced liver cirrhosis in rats (23). In addition, OLE has shown a potential hepatoprotective effect against diazinon in male mice and oxytetracycline-induced albino rats (24). Olive oil has also been shown to have protective effects

on hepatotoxicity caused by combined exposure to acrylamide and aluminum in rats and carbon tetrachloride (CCl<sub>4</sub>)-induced hepatotoxicity in male rats (25,26).

In the study conducted by Elgebaly et al. (27), the effectiveness of olive oil and its extract against fluoxetine-induced liver damage was evaluated. Control rats orally administered physiological saline (1 mL/kg), rats receiving 10 mg/kg/day fluoxetine dissolved in physiological saline, rats receiving 10 mg/kg/day fluoxetine and 1.5 mL/kg extra virgin olive oil orally, and rats receiving 10 mg/kg/day fluoxetine and 100 mg/kg OLE orally were divided into 4 groups and all rats were sacrificed at the end of 7 days and examined biochemically and histopathologically. As a result, it has been shown that olive oil and leaf extract protect against fluoxetine-induced liver damage in rats by reducing oxidative stress, inflammation, and apoptosis (27). OLEs are usually available in capsule or liquid form and are effective when used at lower doses because they are concentrated. It can usually be used in the range of 500-1000 mg per day, but this dosage may vary depending on the concentration of the product. It is recommended to drink 1-3 cups of olive leaf tea per day as tea, while the powder form can be used as 1-2 teaspoons (approximately 5-10 grams) per day. There is a possibility of digestive problems, headaches and skin reactions when consuming olive leaves. It should be used with caution during pregnancy and breastfeeding, in case of allergies, blood clotting problems and low blood pressure, under the supervision of a doctor.

### 3. Conclusion

This article emphasizes the importance and potential of plants used in liver diseases. These plants, which have been used in traditional medicine since ancient times, are supported by experimental studies today and their effectiveness is proven. The active ingredients of the plants play an important role in protecting liver health and in treatment processes.

However, the dosages and possible side effects that should be taken into consideration when using these plants should also be taken into account. Since each plant has its own mechanism of action and may have side effects, the right choices should be made according to the health conditions of individuals. It should also be remembered that these plants should not be used in some cases.

In conclusion, the role of phytotherapeutics in liver diseases will become clearer with further research in the future. Such studies are of critical importance in ensuring the safe and effective use of herbal treatments. Phytotherapeutics should be considered as a complementary part of medical treatment and scientific knowledge in this field should be increased.

#### Footnotes

**Financial Disclosure:** The author declared that this study received no financial support.

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