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REVIEW ARTICLE

HEPATOTOXICITY EFFECTS OF MEDICINAL PLANTS

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Abstract

The liver is a vital organ performing essential functions, such as metabolizing substances and secreting enzymes. A liver issue has a comprehensive impact on the entire body. Numerous factors can lead to liver disease, including genetics, immune system issues, malignant tumors, infections, obesity, alcoholism, malnutrition, diabetes, usage of certain medications, and excessive hormone use. The global accessibility of medicinal herbs has consistently motivated people from diverse cultures to explore their potential benefits. The usage of medicinal plants is pervasive across most of the world's civilizations. Because medicinal plants are natural, some people believe that using medicinal plants is beneficial and risk-free. Herbal use is commonly believed to have minimal or no side effects.

In this review article, we have thoroughly investigated the impact of select medicinal plants on liver toxicity. Various studies and experiences have shown that some plants used for therapeutic and medicinal purposes can seriously harm the liver or aggravate existing liver conditions. Therefore, utilizing standardized herbal remedies or consultation with a specialist in traditional medicine is required. Our study provides a comprehensive summary of recent research on hepatotoxicity available in esteemed databases such as Google Scholar, Scientific Information, PubMed, and Science Direct.

Introduction

Hepatotoxicity, often referred to as toxic hepatitis, is the medical term describing liver damage or malfunction brought on by prescription medications, over-the-counter medications, nutritional supplements, chemical agents, and other factors. Its meaning of poison is derived from the ancient Greek terms hepar (liver) and toxicon (poison) [*Björnsso E, 2016; Teschke R, Andrade R, 2016*]. Experiencing medicines or using herbal remedies might result in two frequent liver adverse reactions: drug-induced liver damage and herbal remedy-induced liver injury [*Teschke et al., 2013*]. The toxicity ranges from moderate to severe hepatic failure and can cause liver damage or death based on alanine aminotransferase levels [*Moreira D et al., 2014*]. Herbal treatments are the second most common cause of drug- or herb-induced hepatotoxicity in Western countries. Self-medication with herbal remedies may have side effects. The research indicated that the increased use of herbal supplements

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was one of the primary causes of the increase in the drug-induced liver damage rate from 7% to 20% [*Stournaras E, Tziomalos K, 2015*]. Furthermore, [*Ballotin V et al., 2021*] discovered that around 79 distinct herbal remedies or herbal components might cause herbal remedy-induced liver injury or liver harm [*Ballotin V et al., 2021*]. In addition, a nationwide investigation carried out in Korea discovered that herbal medications significantly raised the risk of hepatotoxicity [*Suk K et al., 2012*] and drug-induced liver damage (62.5%). Self-medication with herbal treatments will increase the chance of hepatotoxicity. The use of herbal medications for self-medication and severe cases of liver damage are directly correlated. Herbal plants are employed for a variety of medical conditions as well as to improve wellbeing and health in general [*Schoepfer A et al., 2007*]. The biggest global problem that causes severe acute liver damage is that many people wrongly believe that herbal products are not drugs and are completely safe with no side effects. As a result, more people are turning to self-medication with natural medicines, and many use herbal products for various purposes like enhancing overall health and well-being. According to the findings, using herbal supplements for weight loss without a doctor's prescription increases the risk of developing acute liver failure. For instance, one of the most popular herbal products with numerous health benefits is green tea, which is considered a well-known beverage. One of the benefits of green tea is weight loss and weight regulation. Drinking large amounts of green tea causes damage to liver cells [*Fau D et al., 1997; Mazzanti G et al., 2009*]. Studies have shown that using herbal remedies impulsively or without a doctor's advice can damage the liver or interfere with other medications [*Navarro V et al., 2017; Parvez M, Rishi V, 2019*]. It is crucial to inform individuals about the potential risks associated with utilizing herbal remedies for self-medication and require a prescription initially.

MATERIAL AND METHODS

In this summary, all reports on hepatotoxicity related to traditional medicines have been collected from scientific journals published between 1948 and January 2023 in relevant databases, including Google Scholar, PubMed, and Scientific Information. Liver toxicity, side effects, herbal remedies, and hepatotoxicity were searched for many keyword combinations.

RESULTS

Below is a brief description of medicinal plants, with their use in herbal medicine and folk medicine. All medicinal plants are used for only one useful medicinal purpose, but their harmful effects on the body are not taken into account.

ASTERACEAE

***Artemisia argyi*:** Artemisia argyi is a greyish, herbaceous, perennial plant about one-meter height, with short branches and a creeping rhizome. Stem leaves are oval, deeply divided, and covered with small oil-producing glands. The leaves of Artemisia argyi are collected and dried in the shade on hot, dry days in spring and summer when the plant flowers. It can be used as an expectorant, antipyretic, antiseptic, and antiseptic in traditional Chinese medicine because of its bitter and spicy properties. This herb may help cure infertility and dysmenorrhea by boosting blood flow to the pelvic region and promoting menstruation. Also, it can treat asthma and cough. The essential oils may be collected from the leaves and applied to the back of the throat to cure bronchitis and asthma. Staphylococcus aureus, Bacillus subtilis, Escherichia coli, and Pseudomonas are among the bacteria that the leaves effectively combat [*Duke J, Ayensu E, 1985; Yeung H, 1995*].

***Atractylis gummifera*:** In the Mediterranean region, there is a plant species known as Atractylis gummifera L. It belongs to the Asteraceae family. Despite this plant's recognized danger, poisoning from eating still happens often. A. gummifera is toxic because it contains atractyloside and carboxyatractyloside, two diterpenoid glucosides that can prevent mitochondrial oxidative phosphorylation [*Daniele C et al., 2005*]. This plant is used in conventional medicine and frequently results in severe toxicity with lethal outcomes. Most poisoning victims are rural children who mistake the root for other edible plants like Scolymus hispanicus or use the white substance that flows from it as gum [*Madani N et al., 2006; Ahid S et al., 2012*].

***Callilepis laureola*:** Callilepis laureola, a member of the Asteraceae family, is an herbaceous perennial plant commonly found in the grassland habitats of eastern South Africa. It is used in traditional

medicine to treat tapeworms, snakebites, and infertility. It is well known that C. laureola is exceedingly toxic and has even been implicated in many Zulu deaths. According to estimates, this plant alone causes 1,500 deaths per year in KwaZulu-Natal, one of South Africa's nine provinces. Impila is the name given to the plant. The Zulu term, ironically, means ''health'' [*Popat A et al., 2001*].

***Xanthium strumarium*:** This plant is a weed. It is a seed-propagated annual plant with prickly fruits. This plant belongs to the Asteraceae family. X. strumarium is a prevalent plant with a significant harm potential in pasturelands. This plant causes inflammation and swelling of the liver in livestock. This plant is used in traditional medicine and has toxic effects on the human body [*Islam M et al., 2009; Gurley E et al., 2010; Kamboj A, Saluja A, 2010*].

Asphodelaceae

***Aloe vera*:** Aloe vera, also known as aloe, is a plant whose leaf extract is famous in traditional medicine. This plant has long been cultivated as an ornamental plant and a medicinal plant, and it can be kept as an apartment plant and in a pot. Aloe is used in various foods and cosmetic products, including beverages, skin lotions, ointments, and creams. Aloe vera gel is also used to repair superficial skin burns. However, until now, definitive evidence has not been provided regarding the positive therapeutic effects and the safety of oral Aloe vera consumption [*Surjushe A et al., 2008; Guo X, Mei N, 2016*].

Apiaceae

***Petroselinum Crispum*:** The edible vegetable Petroselinum Crispum, popularly known as parsley, is used in various foods, including soups. Typically offered dried and fresh, parsley provides considerable advantages. The findings demonstrate that large continuous oral dosages of the ethanolic extract of P. crispum leave cause hepatotoxicity and nephrotoxicity, whereas lesser doses have no discernible adverse effects [*Awe E, Banjoko O, 2013; Tang W et al., 2015*].

Apocynaceae

***Nerium oleander*:** All the stems, leaves, and flowers of Nerium oleander are poisonous because of its cardiac glycosides, particularly oleandrin. N. oleander grows in hot, dry climates. Oleander poisoning can occur from any part of the plant, and breathing in smoke from a burned part can also be harmful. It is highly poisonous to use the branches of this plant for various uses and to drink water near cluster blooms. Despite the hazards posed by this deadly evergreen plant, gardeners in a Mediterranean environment have a strong desire to cultivate it [*Szabuniewicz, 1971; Szabuniewicz et al., 1972; Hougen T et al., 1979; Langford S, Boor P, 1996*].

Boraginaceae

***Borago officinalis*:** The annual herbaceous plant Borago officinalis has medicinal properties. There are medicinal uses for its flowers, leaves, and blooming branches. This plant, often referred to as the starflower, is native to the Mediterranean area. It has been used throughout history for culinary and medical purposes to treat swelling, inflammation, respiratory ailments, and depression. It has been noticed that it has therapeutic properties against obesity, diuretic, emollients, laxatives, anti-anemia, anti-menstrual discomfort, and antifever [*Asadi-Samani M et al., 2014; Lozano-Baena M et al., 2016*].

***Symphytum officinale*:** Symphytum Officinale is a medicinal plant native to Europe and warm regions of Asia. The products of Hass are prepared from the leaves or other upper parts of the plant (not its roots). Using the root part can lead to poisoning. S. officinale contains allantoin, rosmarinic acid, and pyrrolizidine-type alkaloids. Though S. officinale is regarded as a helpful herb, scientific investigation has revealed that it has the potential to be highly harmful. There is a risk of toxicity if S. officinale products are ingested as drinks or used in other ways for internal uses. According to reports, using S. officinale -contained products for medicinal reasons has a risk of mortality whether used orally or topically. Pyrrolizidine alkaloids, which are harmful to the liver, are found in several plants of the S. officinale genus. Echimidin is the most toxic pyrrolizidine alkaloid that occurs in S. officinale. Symphytum officinale usually does not contain toxic pyrrolizidine alkaloids. Some of the S. officinale products are from other species, such as S. asperum and S.uplandicum, which have Echimidin content. The roots of all the species of the S. officinale contain ten times more toxic substances than their leaves [*Miranda C, 1981; Mei N et al., 2010; Cameron M, 2013; Brown A et al., 2016; Moreira R et al., 2018*].

***Cordia salicifolia*:** The leaves and fruits of this plant contain compounds such as caffeine, allantoin, allantoic acid, β-sitosterol, and spathulenol, as well as a significant potassium content. This plant has been used as an appetite suppressant and proper wound healing. It shows activity against herpes simplex virus type 1 in vitro [*Hayashi K et al., 1990; Taylor, 2005; Menghini L et al., 2008; Schezaro-Ramos R et al., 2020*].

***Heliotropium lasiocarpum*:** It is a perennial alkaloid-producing plant with a wide geographic distribution. The aerial part of H. Lasiocarpum contains a variety of alkaloids. The use of this plant as herbal tea is known to cause Veno-occlusive disease [*Culvenor C et al., 1986; Chernenko T et al., 2011*].

CELASTRACEAE

***Tripterygium wilfordii*:** It has been used to treat psoriatic and rheumatoid arthritis. However, because of safety concerns, its use is not advised. Various studies have shown that the chemicals in the plant cause severe liver toxicity. Also, T. wilfordii bark extracts have been used as insecticides in China for centuries. T. wilfordii extracts can have significant side effects, including immunosuppression. In August 2011, the UK Medicines and Healthcare Products Regulatory Agency published a drug safety bulletin advising consumers not to use medicines containing Li Gongteng due to potentially serious side effects. The State Food and Drug Administration of China issued a warning and caution about this drug in April 2012 [*Luo D et al., 2004; Lopez L et al., 2005; Zhang C et al., 2016; Chang H et al., 2021*].

***Catha edulis*:** A blossoming plant known as Catha edulis is native to the tropical regions of East Africa and the Arabian Peninsula. Khat is said to be the act of gradually sucking the sap of the Catha plant. The World Health Organisation has classified khat as a type of narcotic substance since 1973, and it is widely grown throughout most of Ethiopia. The leaves can be kept in the refrigerator for up to a week. Addicts put the leaves of this plant in their mouths and gradually suck its extract [*Nutt D et al., 2007; Al Mugahed, L 2008; Wabe N, 2011*].

CYCADACEAE

***Cycas revolute*:** The Cycadaceae family includes the species C. revoluta. This plant's leaves have severely toxic, and eating them can result in severe stomach discomfort, immediate digestive problems, severe diarrhea, severe vomiting, and eventually death [*Chang S et al., 2004; Forrester M et al., 2020*].

DIOSCOREACEAE

***Dioscorea bulbifera*:** This plant is native to Africa, Asia, and northern Australia. It is widely cultivated and naturalized in many areas. Uncultivated variants, like those that naturally grow in Florida, might be poisonous. These species contain the steroid diosgenin, which is a primary compound in synthetic steroid hormones used to prevent conception. D. bulbifera are used as a folk remedy to treat conjunctivitis, diarrhea, and dysentery [*Duke J, 1993; Pieroni A, 2005; Wang J et al., 2010; Li H et al., 2020*].

EPHEDRACEAE

Ephedra sinica: It is a plant known as ephedra or Ma Huang in China that is mainly used in traditional Chinese medicine [*Abourashed E et al., 2003; Fan Y et al., 2015*].

Euphorbiaceae

Ricinus communis: The castor bean fruit is a greenish (or red-purple) spherical and spiny capsule that becomes hard and brittle when ripe. Large, oval, bean-shaped seeds have a glossy exterior and an extremely oily cream or white kernel on the inside. The plant produces brown, highly toxic seeds. Castor seeds contain the very poisonous protein Ricin. One of the most lethal naturally occurring toxins is present in the skin of these seeds [*Worbs S et al., 2011; Moshiri M et al., 2016*].

FABACEAE

Abrus precatorius: The seeds of the perennial plant A. precatorius are the most famous for being used as beads. Due to the presence of an Abrin, it is toxic. This plant's root, seed, and leaf have historically been considered for their cleansing, tonic, aphrodisiac, and hair growth-enhancing properties [*Barve K, Ojha N, 2013*].

Cassia angustifolia: Cassia angustifolia was used in the form of senna pods, or as an herbal tea made from the leaves, as a laxative. It also acts as a fungicide. Modern medicine has used extracts as laxatives since at least the 1950s [*Duke J, 2002; Spiller H et al., 2003*].

Pueraria montana: Pueraria montana is a species of the Fabaceae plant family. This plant is native to China and has spread to many tropical regions, such as Europe and America. The root of P.

montana var. thomsonii is generally used as food and for starch extraction. The root can also be used to make another herbal remedy in China known as Puerariae thomsonii radix (also called Fenge) [*Bodner C, Hymowitz T, 2002; Zhang G et al., 2020*].

Hydrangeaceae

Dichroa febrifuga Lour: Dichroa Febrifuga is a crucial plant and one of the fundamental herbs in traditional Chinese medicine. The antimalarial effects are thought to be caused by the alkaloids of febrifugine and isofebrifugine [*Chou T et al., 1948*].

Lamiaceae

Teucrium polium: This plate is one of the plants used in conventional medicine, and its dried decoction is used as a breath freshener. Additionally, it is applied to wounds to reduce pain and is also used to treat stomachaches and colic, although it has the potential to damage the liver [*Rafieian-Kopaei M et al., 2014; Bahramikia S et al., 2022*].

Orthosiphon stamineus: It is a common herb in traditional Chinese medicine that has been used to treat diabetes and some kidney diseases. Modern pharmacological studies show that O. stamineus has many medicinal activities, including antioxidant, anti-inflammatory, kidney protection, antibacterial, anti-tumor, and immune regulation [*Sun Z et al., 2014; Ma G et al., 2015; Li Y et al., 2017b*].

Mentha pulegium: Due to its high concentration, oregano essential oil is dangerous and lethal even in small doses. Patients who utilized its concentrated essential oil for various purposes have reportedly died as a result. The essential oil of M. pulegium contains 80-92% cyclohexanone polygon. Polygon is the molecule that creates the aroma and taste of mint and causes various diseases. Small doses of oregano oil (10 *ml*) may cause symptoms including nausea, vomiting, stomach discomfort, and disorientation. Taking a higher dose can cause the failure of several body organs and lead to death. Pregnant women are not allowed to use it, after a request from the US Congress [*Siano F et al., 2005; Da Rocha M et al., 2012*].

Meliaceae

Melia toosendan: Fructus Meliae Toosendan is a traditional Chinese medication that is bitter tasting, cold in nature, and listed in the Chinese Pharmacopoeia. This plant is used to kill insects as well as to reduce discomfort from ruptured intestine parasite infestations and stomach pain [*Chang H et al., 2023*].

Marantaceae

Maranta arundinacea: Maranta arundinacea, often known as arrowroot. L is a common Indonesian tuber plant. Arrowroot starch is highly digestible and is commonly used as a thickener in various foods such as puddings and sauces, cookies, and other baked goods. Arrowroot is suitable for neutral diets, especially for people with nausea. Some people believe that arrowroot helps relieve stomach upset [*Kumalasari I et al., 2012*].

Menispermaceae

Stephania sinica: Its tuberous root has been used as a traditional folk remedy for cancer, fever, cough, malaria, diarrhea, abdominal discomfort, stomachache, and trauma injuries. It acts as an anti-inflammatory, pain reliever, and sedative [*Jiang Y et al., 2020; Li X et al., 2022*].

Papaveraceae

Chelidonium majus: Because it contains a variety of Isoquinoline alkaloids, the plant is poisonous in moderate concentrations. A suitable dose is necessary for use in herbal medicine. Copticin is the primary alkaloid present in the plant and root. It is used to prepare a variety of external therapies for skin conditions, including warts [*Joerg G et al., 2000; Cahlíková L et al., 2010*].

Polygonaceae

Polygonum multiflorum: Reynoutria multiflora is listed in the Chinese Pharmacopoeia and is one of the most popular perennial Chinese traditional medicines. However, due to the risk of toxic hepatitis from an overdose, monitoring should be applied [*Jung K et al., 2011*].

Piperaceae

Piper methysticum: Kava (Piper methysticum), an herbal anti-anxiety drug, was banned in the UK and other countries. Hepatotoxicity was found in about 70 cases [*Ernst E, 2007*].

Ranunculaceae

Actaea Racemosa: This plant is mainly offered as a food supplement to women as a treatment for premenstrual and menopausal symptoms [*Mahady G, 2005; Mohapatra S et al., 2022*].

Rutaceae

Agathosma betulina: The essential oil and extract of the leaves are used as a flavoring for tea, candy, and alcoholic beverages known as Buchu Brandy in South Africa. The two main chemical components of A. betulina essential oils are isom-

TABLE

Medicinal plants with hepatotoxicity effect

Plant name	Family	Potential therapeutic application (Traditional medicine)	Type of adverse effect	References
Artemisia argyi	Asteraceae	Treat of dysmenorrhea, abdominal pain, and inflammation	Hepatocellular	Liu et al., 2019; Liu et al., 2017
Abrus precatorius	Fabaceae	Treat of tetanus, and to prevent rabies	Liver failure	Alhamdani et al., 2015; Garaniya and Bapodra, 2014
Atractylis gummifera	Asteraceae	Treat of intestinal parasites, ulcers, snakebite poisoning	Panlobular hepatic necrosis	Achour et al., 2013; Georgiou et al., 1988
Aloe vera	Asphodelaceae	Immunomodulatory, wound and burn healing, anticancer, gastro-protective	Acute hepatitis	Kanat et al., 2006; Rabe et al., 2005
Actaea Racemosa	Ranunculaceae	Treat of menopausal symptoms	Injury of liver cells, necrosis of hepatocytes	Enbom et al., 2014
Agathosma betulina	Rutaceae	Treat inflammation, and kidney and urinary tract infections	Idiopathic liver injury	Engels et al., 2013
Agathosma crenulata	Rutaceae	Treat of urinary tract infections	Idiopathic liver injury	Engels et al., 2013
Borago officinalis	Boraginaceae	Treat of fever, cough, and depression	Liver failure	Vacillotto et al., 2013
Blighia sapida	Sapindaceae	Treat of yellow fever, epilepsy and oedema, and as a laxative and diuretic	Liver injury	Blake et al., 2006; Ekué et al., 2010
Callilepis laureola	Asteraceae	Treat of tapeworm, snakebite, infertility, pregnancy tonics	Injury of liver cells	Popat et al., 2001; Wainwright and Candy, 1977
Cycas revoluta	Cycadaceae	Treat of blood vomiting, flatulence, skin diseases, gastrointestinal distress	Hepatocellular	Sieber et al., 1980
Camellia sinensis	Theaceae	Reduce the enlargement of the heart, improve blood pressure dysfunction	Liver damage	Mazzanti et al., 2015; Mazzanti et al., 2009
Cascara sagrada	Rhamnaceae	Laxative for constipation	Liver injury	Nadir et al., 2000
Chelidonium majus	Papaveraceae	Treat of whooping cough, asthma, jaundice, gallstones	Liver injury	Benninger et al., 1999; Greving et al., 1998
Cassia angustifolia	Fabaceae	Treat of constipation, typhoid	Acute Liver Failure	Vanderperren et al., 2005
Catha edulis	Celastraceae	Treat of depression, fatigue, obesity, stomach ulcers	Liver damage	Riyaz et al., 2014
Cordia salicifolia	Boraginaceae	Diuretic, anti-inflammatory	Liver injury	Chain, 2011
Dioscorea bulbifera	Dioscoreaceae	Treat of dysentery, syphilis, ulcers, cough, diabetes, asthma, and cancer	Liver injury	Li et al., 2020; Wang et al., 2010
Dichroa febrifuga Lour	Hydrangeaceae	Used as an antimalarial	Liver injury	Saxena and Saxena, 1986; Tang and Eisenbrand, 2013
Ephedra sinica	Ephedraceae	Treat of asthma, bronchitis, and hay fever	Liver failure	Neff et al., 2004; Seif et al., 2021
Heliotropium lasiocarpum	Boraginaceae	Antipyretic	Liver injury	Frenzel and Teschke, 2016
Lantana camara	Verbenaceae	Treat of asthma, ulcers, swellings, eczema, tumors, high blood pressure	Liver Failure	(Johnson and Jensen, 1998)
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Table (Continued)

Medicinal plants with hepatotoxicity effect

Plant name	Family	Potential therapeutic application (Traditional medicine)	Type of adverse effect	References
Lantana camara	Verbenaceae	Treat of asthma, ulcers, swellings, eczema, tumors, high blood pressure	Liver Failure	Johnson and Jensen, 1998
Larrea tridentate	Zygophyllaceae	Treat of infertility, rheumatism, diabetes, gallbladder and kidney stones	Liver Failure	Sheikh et al., 1997
Larrea divaricata	Zygophyllaceae	Anti-inflammatory properties	Liver Failure	Alderman et al., 1994; Katz and Saibil, 1990; Smith and Desmond, 1993
Mentha pulegium	Lamiaceae	Treat of digestive disorders, amenorrhea, gout, colds, and skin disease	Liver injury	Gordon et al., 1987; Sullivan et al., 1979
Melia toosendan	Meliaceae	Treat of leprosy, eczema, asthma, malaria, fever, and pain	Liver injury	Frenzel and Teschke, 2016; YUEN et al., 2006; Zheng et al., 2018
Maranta arundinacea	Marantaceae	Treat of urinary infections, smallpox sores, and as antidote for poisons	Liver damage	Kim et al., 2009
Morinda citrifolia	Rubiaceae	Treat of cancer, gastric ulcers, depression	Acute hepatotoxicity	Elizabeth et al., 2011; López-Cepero Andrada et al., 2007
Nerium oleander	Apocynaceae	Treat of asthma, epilepsy, cancer, painful menstrual periods	Liver injury	Altan et al., 2009
Orthosiphon stamineus	Lamiaceae	Treat of arthritis, and inflammatory related conditions	Liver injury	López et al., 2004
Pueraria montana	Fabaceae	Treat of alcoholism, fever, colds, measles, angina, and dysentery	Liver injury	Kim et al., 2015
Petroselinum Crispum	Apiaceae	Anti-diabetic, analgesic, spasmolytic, immunosuppressant, anti-anemic	Liver injury	Awe and Banjoko, 2013
Polygonum multiflorum	Polygonaceae	Treat of backache, dizziness, graying of the hair and constipation	Liver injury	Cárdenas et al., 2006; Rao et al., 2021
Piper methysticum	Piperaceae	Treat of fever, respiratory problems, and urogenital problems	Liver injury	Bujanda et al., 2002; Escher et al., 2001; Russmann et al., 2001
Rhamnus purshiana	Rhamnaceae	Relief of constipation	Liver injury	Nunes et al., 2022
Ricinus communis	Euphorbiaceae	Treat of backache, muscle aches, bilharziasis, backache and sciatica	Liver injury	Audi et al., 2005; Khan Marwat et al., 2017
Senecio jacobaea	Asteraceae	Treat diabetes	Liver injury	Miranda et al., 1982; Miranda et al., 1981
Stephania sinica	Menispermaceae	Treat of asthma, tuberculosis, hyperglycemia, malaria, cancer and fever	Liver injury	Teschke et al., 2012
Symphytum Officinale	Boraginaceae	Treat of wounds and reduce inflammation from sprains and broken bones	Liver injury	Hirono et al., 1978; Mei et al., 2005
Teucrium polium	Lamiaceae	Treat of gastrointestinal disorders, diabetes and rheumatism	Liver injury	Mattéi et al., 1995; Starakis et al., 2006
Tripterygium wilfordii	Celastraceae	Treat of rheumatoid arthritis, systemic lupus erythematosus	Liver injury	Tian et al., 2019
Viscum album	Santalaceae	Treat of high blood pressure, dizziness, and arthritis	Liver injury	Kim et al., 2015
Xanthium strumarium	Asteraceae	Treat of rhinitis, nasal sinusitis, headache, gastric ulcer, urticaria	Liver injury	Wang et al., 2011; Xue et al., 2014

enthone and diosphenol. The indigenous inhabitants of South Africa have utilized this plant as a traditional treatment for a wide range of illnesses, including urinary tract infections [*Moolla A, Viljoen A, 2008; Cock I et al., 2021; Brendler T, Abdel-Tawab M, 2022*].

Agathosma crenulata: The Agathosma crenulata is a flowering plant which belongs to the Rutaceae family. The plant produces several sweet-smelling white flowers. The leaves of this plant have been used as a tea to relieve stomach problems [*Brendler T, Abdel-Tawab M, 2022*].

RUBIACEAE

Morinda citrifolia: This plant is accessible as a supplement in various formats, such as capsules, cosmetic products, and fruit juice. Additionally, this plant has been used to produce a variety of beverages, powders (from ripe or unripe fruits), skin care products (lotion, soap), oil (from seeds), and leaf powders, all of which have been distributed to consumers [*Potterat O, Hamburger M, 2007; Almeida E et al., 2019; Inada A et al., 2020*].

RHAMNACEAE

Rhamnus purshiana: In the past, Native Americans used the bark of this tree as a laxative. R. purshiana was used to treat severe and long-standing constipation before it was made widely accessible as a pharmaceutical [*Liu L, 2011*].

SAPINDACEAE

Blighia sapida: It has been used in nations in sub-Saharan Africa as well as in other regions of the world, including the Caribbean, North and South America, and Europe. Many diseases, including backaches, constipation, cancer, fever in young children, gonorrhea, dysentery, psychosis, hernia, stomachaches, malaria, rheumatism, typhoid, etc., are historically treated with it [*Gaillard Y et al., 2011; Otegbade O et al., 2017; Sinmisola A et al., 2019*].

SANTALACEAE

Viscum album: It is a semi-parasitic plant that attacks trees such as elm, apple, pear, and chestnut. The fruits are yellow-white in bunches and are the size of peas with sticky flesh and tiny seeds. European V. album can be lethal, and ingesting the berries can cause severe illness. The V. album contains a ribosome-inactivating protein called viscumin, a cytotoxic protein. Viscumin can be internalized by endocytosis after binding to the galactose residues of cell surface glycoproteins. Viscumin significantly reduces protein synthesis by deactivating the ribosomal subunit 60 S. The structure of this protein is very similar to other ribosome-inactivating proteins and shows the most similarity to ricin and abrin [*Nazaruk J, Orlikowski P, 2016; O'Neill A, Rana S, 2016*].

THEACEAE

Camellia sinensis: The leaves of these trees are used to make tea. The beverage's name is black tea. About 5,000 years ago, the tea plant was discovered for the first time in China, where it was increasingly utilized for coloring, in addition to its medicinal uses. Black tea and green tea were once considered wealthy and pricey beverages since they were first served in the royal residences of Asia as a brew that was enjoyable and good for the body [*Aboulwafa M et al., 2019; Prasanth M et al., 2019; Wang Y et al., 2021; Zhao T et al., 2022*].

VERBENACEAE

Lantana camara: Lantana camara is a perennial plant and shrub. Studies have shown that Lantana leaves can exhibit antimicrobial, fungicidal, and insecticidal properties. L. camara is also used in traditional herbal medicine to treat various diseases, including cancer, itchy skin, leprosy, chicken pox, measles, asthma, and ulcers. Lantana camara is toxic to animals, such as cattle, sheep, horses, dogs, and goats. The active ingredients that cause toxicity in grazing animals are pentacyclic triterpenoids, which lead to liver damage and photosensitivity. Several studies also show that eating unripe green fruits of the plant are poisonous for humans [*Ahmed R et al., 2007; Sharma O et al., 2007; Barceloux D, 2008*].

ZYGOPHYLLACEAE

Larrea tridentate: IThis medicinal plant grows in the southwestern United States, northern Mexico, and Argentina. Native Americans in the Southwest believed this plant cured many ailments, including sexually transmitted diseases, tuberculosis, chicken pox, dysmenorrhea, and snakebite. Coahuiltecan Indians used this plant for intestinal disorders and tuberculosis. The Tohono O'odham Indians used it medicinally for stiff limbs, snake bites, and menstrual pains. The shrub is still widely used as an herbal medicine in Mexico [*Bowers J, 1993; Arteaga S et al., 2005*].

Larrea divaricate: Lignans are polyphenolic compounds found in the resin that may have medicinal uses. In addition, this plant includes flavonoids, triterpene, guaritic acid and its derivatives, and other chemical compounds. L. divaricate extract has been employed as an abortifacient in the past. Additionally, it has been demonstrated that an aqueous extract is effective against the gram-negative bacteria Helicobacter pylori, which is prevalent in the stomach and is related to gastritis, pep-

tic ulcers, and gastric cancer [*Stege P et al., 2006; Rodriguez-Fragoso L et al., 2008*].

Our goal was to identify the side effects of the above-described plants, especially with an emphasis on their effect on the functional state of the liver. According to numerous studies, improper and underdosed use of medicinal herbs during self-medication can lead to irreversible liver damage and should only be carried out with a doctor's prescription. table, in addition to their direct purpose, also shows specific liver disorders for each medicinal plant.

Conclusion

The usage of medicinal plants is pervasive across most of the world's civilizations. Because medicinal plants are natural, some people believe that using medicinal plants is beneficial and risk-free. Various studies and experiences have shown that some plants used for therapeutic and medicinal purposes can seriously harm the liver or aggravate existing liver conditions. Therefore, utilizing standardized herbal remedies or consultation with a specialist in traditional medicine is required.

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