https://doi.org/ 10.33472/AFJBS.6.5.2024. 4359-4423

African Journal of Biological Sciences

Plant-Based Hepatoprotective Remedies: A Review

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Article History
Volume 6, Issue 5, 2024
Received: 09 May 2024
Accepted: 17 May 2024
doi: *10.33472/AFJBS.6.5.2024. 4359-4423*

Abstract :

The liver is an important organ with many functions needed for overall wellness, infections, and illnesses. Hepatoprotective effects serve as an important role in maintaining the liver from harm and helping its regeneration.The objectives include performing a comprehensive literature analysis in order to improve the efficiency and mechanisms of action of natural medicines in hepatoprotection.These medicines shows multiple functions including antioxidant, anti-inflammatory, and detoxifying qualities which together protects the liver from injury and helps in its recovery.Key natural substances such as curcumin, silymarin, omega-3 fatty acids, N-acetylcysteine, and vitamin E are highlighted for their extraordinary hepatoprotective benefits. These substances works through different channels, including antioxidative processes, regulation of inflammatory responses, and acceleration of liver cell regeneration.Despite advances in traditional medicine limitations and adverse effects associated with pharmacological treatments indicates the need for studying other approaches. Phytochemicals produced from plants shows hepatoprotective properties with other therapeutic advantages.

Key Words : Liver , Natural medicines , Hepatoprotective

HEPATOPROTECTIVE ACTIVITIES :

The concept of "hepatoprotective activities" refers to a substance's remarkable ability to shield the liver from harm while simultaneously promoting its overall well-being .

THIS ACTIVITIES INCLUDES :

Fighting Bad Stuff: Our livers might be impacted by certain substances in our bodies.Hepatoprotective actions or measures protect our liver by resisting these dangerous toxins .

Reducing Swelling: Sometimes, our liver might grow enlarged and irritated. Hepatoprotective actions assist to minimize this swelling so that our liver can stay healthy.

Helping the Liver: If our liver becomes harmed, it needs to recover. Hepatoprotective functions allow our liver to repair faster so that it can perform normally again.

Cleaning the Liver: Our liver works hard to clear out harmful material from our body. Hepatoprotective actions assist our liver accomplish its task better .

Protecting Against Harmful Substances: Some items we eat or drink can affect our liver. Hepatoprotective functions protect our liver from these toxic chemicals .

Maintaining Liver Enzymes Normal: Our liver creates specific molecules called enzymes. Liver-protective actions contribute to maintaining these enzymes at normal levels, which is a sign of good liver health .

Avoiding Fat Formation: Too much fat in our liver might make it unwell. Hepatoprotective functions help avoid too much fat from building up in our liver .

Improving Blood Flow: Our liver requires excellent blood flow to be healthy. Hepatoprotective actions assist enhance blood flow to our liver, keeping it robust and healthy.

Pathophysiology of the Liver :

The liver consists of four lobes the right, left, caudate, and quadrate. On the lower portion of the right lobe rests the quadrate lobe. The caudate lobe is Located before and above the left and right lobes.The liver is the body's greatest gland and plays a key duty in absorbing nutrients and removing hazardous substances. It operates as both an exocrine and endocrine organ generating bile salts, controlling blood sugar and making essential proteins and lipids. Also, it stores vitamins and minerals and metabolizes numerous chemicals. [18]

The liver is vital for metabolism, breaking down lipids for energy and creating bile for fat digestion.It manages blood sugar levels by storing and releasing glycogen as necessary. Additionally it metabolizes proteins converting amino acids and detoxifying ammonia into urea. It creates clotting proteins with Vitamin K and helps in eliminating old blood cells. Also, the liver detoxifies the blood by removing alcohol and drug byproducts.[19]

Understanding the pathophysiology of the liver requires knowledge of the processes behind various liver illnesses and dysfunctions.The following is a brief description :

Hepatic inflammation : It serves as a prominent starting point of liver illnesses, working as the main cause for the loss of hepatic tissue integrity. Its essential importance can be seen by its contribution to the transition from non-alcoholic fatty liver disease (NAFLD) towards the later stages characterized by significant fibrogenesis, culminating eventually in the development of hepatocellular carcinoma (HCC). This inflammatory process inside the liver not just affects its normal physiological activities but also puts into motion a chain of pathological events that gradually worsen the disease leading to the emergence of serious liver problems. {20}

Fibrosis : It indicates an ongoing pathological process defined by the formation of fibrous connective tissue inside the extracellular matrix (ECM) of various tissues that have suffered from damage. This condition in spite of increasing slowly over time releases substantial effects for a number of disorders affecting the Liver. The steady growth of fibrosis starts a series of events that result in tissue degradation affecting the normal physiological activities of afflicted organs. This excessive deposition of fibrous

tissue not only changes the structural integrity of the ECM but also disturbs the complex balance of cellular interactions within the affected tissues. As fibrosis proceeds, it instigates a cycle of escalating damage eventually leading to severe morbidity and death linked with a variety of chronic illnesses.[21]

Metabolic Disorders : Metabolic liver illnesses such as α1-antitrypsin deficiency need transplantation once liver damage becomes permanent. Due to their systemic effects the pre-transplant testing requires a full evaluation to identify any systemic disorders that might interfere with transplantation. [22]

Cholestasis indicates a disturbance in either the production or flow of bile clinically showing with symptoms such as weariness, pruritus, and jaundice. The spectrum of cholestatic liver conditions covers a wide variety of diseases and the underlying causes of cholestasis may vary significantly in terms of the anatomical position of the defect and the seriousness of presentation. Cholestasis can occur under numerous clinical circumstances needing a broad hold of its symptoms among medical professionals who have different clinical backgrounds.[23]

Literature Survey

OBJECTIVE :

The primary objective is to perform a complete review of the available literature on natural medicines with hepatoprotective effects. This includes choosing relevant research, summarizing their findings, and applying the material to acquire knowledge about the efficacy and mechanisms of action of various therapies.

INTRODUCTION

The liver is an important organ responsible for many functions required for maintaining overall health.[1,2,3] Some of its important functions include:

1. Purification: It plays an important role in detoxifying harmful substances such as narcotics, alcohol, and metabolic waste products.These substances are changed by the liver into less harmful compounds that the body may eliminate.[1,2,3]

2. Metabolism: The liver turns proteins, lipids, and carbohydrates into energy the body can use. Also, by storing extra glucose as glycogen and releasing it as needed, it helps in blood sugar regulation.[1,2,3]
3. Synthesis: Important proteins produced by the liver include clotting factors required for blood coagulation and albumin, that helps in maintaining blood osmotic pressure.[1,2,3]
4. Immune function: Kupffer cells are specialized immune cells found in the liver that help with immune defense by helping in the removal of bacteria and other foreign particles from the blood flow.[1,2,3]
5. Storage: It stores essential vitamins (such as A, D, E, and K) and minerals (such as iron and copper) that the body needs for various functions.[1,2,3]

As the liver plays such an important part in metabolism and detoxification, it is essential to maintain good liver health for overall wellbeing. But a number of things, including excessive consumption in alcohol, infectious , fatty liver disease, certain drugs, and environmental pollutants can damage the liver and cause serious illnesses including cirrhosis, liver cancer and hepatitis.[1,2,3,4]

In order to protect the liver from injury while promoting its regeneration hepatoprotective medications can be used. These chemicals functions by numerous processes including antioxidant abilities, anti-inflammatory effects, stimulation of liver cell regeneration and augmentation of detoxification pathways [5,6,7,8,9,10].Some commonly used hepatoprotective medications are :

- Curcumin: Curcumin is obtained from turmeric, it contains anti-inflammatory and antioxidant properties, protecting the liver from damage and reducing inflammation related with liver diseases.[5,6]
- Silymarin: It acts as an effective antioxidant, protecting the liver cells from harm caused by toxins and oxidative stress.[5,6]
- Omega-3 fatty acids: It is Found in fish oil, it shows anti-inflammatory qualities that reduces liver inflammation and improve liver function.[7,8]

- N-acetylcysteine : It helps in recovering glutathione levels in the liver an antioxidant that is essential in neutralizing toxins.[9]
- Vitamin E : This antioxidant protects liver cells from oxidative damage caused by free radicals.[10]

THE NEED OF NATURAL REMEDIES :

Liver diseases causes serious global health issues affecting millions and placing substantial economic and healthcare costs. Regardless of developments in medicine, handling these conditions remains difficult with traditional treatments often limited by harmful effects and incomplete effectiveness . Access to specialized care and expensive medicines worsens healthcare inequalities. Understanding these limits there's an increasing interest in natural remedies for liver health. Obtained from plants and Traditional practices these treatments offer potential hepatoprotective effects with more healing benefits. They often have better properties than manufactured drugs and can target multiple pathways involved in liver damage and recovery. Yet, scientific proof supporting their effectiveness is still changing requiring detailed clinical studies for molecular understanding, optimal dosing and long-term safety.[5,11]

OVERVIEW OF HEPATOPROTECTIVE NATURAL REMEDIES :

Hepatoprotective reagent : This are chemicals that helps in protecting the liver from damage and promotes its recovery. These agents work through different processes, including antioxidant benefits, anti-inflammatory qualities, promotion of liver cell regrowth and improvement of cleansing pathways. They are used to avoid or reduce liver damage caused by factors such as excessive alcohol usage, viral infections, fatty liver diseases, certain medicines and environmental toxins. Examples of hepatoprotective drugs include silymarin, N-acetylcysteine (NAC), turmeric, vitamin E and omega-3 fatty acids.[1,2,3,4,5,6,7,8,9,10]

INTRODUCTION TO KEY PHYTOCHEMICALS :

Phytochemicals are substances that are naturally found in plants. These chemicals have a wide range of biological qualities such as antioxidative, anti-inflammatory and cleansing effects which add to their ability to protect the liver from damage and promote its recovery.[12]

Understanding the mechanisms of action of key phytochemicals is essential for identifying their therapeutic potential in liver health, here we look into a few of these important phytochemicals and their potential MOA in hepatoprotective activities supported by relevant scientific studies.

- Silymarin:

Silymarin comes from the milk thistle plant (Silybum marianum). It includes several flavonolignans such as silybin, silydianin, and silychristin, which have high antioxidant and anti-inflammatory properties.[5,6]

Silymarin's mechanism of action involves the elimination of free radicals, the inhibition of lipid peroxidation and the modification of communication routes associated with liver injury. Research investigations have shown silymarin's effectiveness in protecting the liver from damage caused by chemicals, medications and oxidative stress, showing its potential as an important component for liver health.[5,6,14]

- Curcumin:

Curcumin, the active component of turmeric (Curcuma longa), is renowned for its various pharmacological properties including hepatoprotection.[5,6,]

Its mechanism of action includes antioxidative, anti-inflammatory and anti-fibrotic properties, which contribute to its ability to reduce liver damage and promote regeneration. Curcumin targets molecular pathways involved in liver illnesses, including NF-κB, TGF-β, and hepatic stellate cell activation, showing its potential therapeutic efficacy in liver problems.[5,6,15,16]

- Resveratrol:

Resveratrol is a polyphenolic compound which can be found in plants, grapes and berries.

Its MOA covers antioxidative, anti-inflammatory and anti-fibrotic effects which helps in reducing liver damage and fibrosis. Resveratrol effects many processes that are involved in liver diseases such as AMP-activated protein kinase (AMPK) and sirtuin 1 (SIRT1) leading to improved liver function and decreased hepatic steatosis.[5,6,17]

- Epigallocatechin Gallate :

Epigallocatechin Gallate is a catechin found in green tea that shows high antioxidative and anti-inflammatory actions with hepatoprotective potential.

Its MOA involves removing reactive oxygen species (ROS), preventing lipid peroxidation and modulating inflammatory pathways resulting in reduced liver inflammation and damage. EGCG has showed progress in experimental models of liver diseases including non-alcoholic fatty liver disease and alcoholic liver disease.[13]

Plants used as remedies for Hepatoprotective activities

Si.no.	Local Name	Scientific Name	Mode of Action used	***Reference/ Citations***
01	Milk thistle	*Silybum marianum*	Milk thistle contains silymarin which is made up of flavonoids such as silybin, silydianin, and silychristin. Silymarin has many benefits including fighting toxic compounds, reducing inflammation, and supporting liver function. It increases liver function by improving protein synthesis supporting in the repair of damaged liver cells, and avoiding the development of damaging free radicals.	Teschke R, Wolff A, Frenzel C, Schulze J. Review article: Herbal hepatotoxicity--an update on traditional Chinese medicine preparations. Aliment Pharmacol Ther. 2014 Jul;40(1):32-50. doi: 10.1111/apt.12798. Epub 2014 May 20. PMID: 24844799.

Si.no.	**Local Name**	**Scientific Name**	**Mode of Action used**	***Reference/ Citations***
02	Dandelion	*Taraxacum officinale*	Dandelions consist of helpful components such flavonoids and sesquiterpene lactones that improve liver function. These components help in bile formation, improve liver function and fight toxic chemicals that induce inflammation. In short, dandelions function as a protective barrier for your liver, maintaining its well-being and protection.	Schütz K, Carle R, Schieber A. Taraxacum--a review on its phytochemical and pharmacological profile. J Ethnopharmacol. 2006 Oct 11;107(3):313-23. doi: 10.1016/j.jep.2006.07.021. Epub 2006 Jul 22. PMID: 16950583.
03	Turmeric	*Curcuma-longa*	Turmeric contains curcumin, a unique chemical that plays an essential function in maintaining liver health. Curcumin has many advantages including fighting toxic compounds, decreasing inflammation and preventing liver scarring. Basically, it functions as a protective barrier for your liver neutralizing free radicals, reducing inflammation and reducing excessive scarring.	Hewlings SJ, Kalman DS. Curcumin: A Review of Its Effects on Human Health. Foods. 2017 Oct 22;6(10):92. doi: 10.3390/foods6100092. PMID: 29065496; PMCID: PMC5664031.

Si.no.	**Local Name**	**Scientific Name**	**Mode of Action used**	***Reference/ Citations***
04	Artichoke	*Cynara scolymus*	Artichokes are enriched in cynarin, flavonoids, and other bioactive chemicals that give huge advantages to the liver. They improve bile synthesis, improve liver detoxification processes and exhibit antioxidant and anti-inflammatory effects. As a result they serve an important role in protecting the liver from injury and improving its general health.	Colak E, Ustuner MC, Tekin N, Colak E, Burukoglu D, Degirmenci I, Gunes HV. The hepatocurative effects of Cynara scolymus L. leaf extract on carbon tetrachloride-induced oxidative stress and hepatic injury in rats. Springerplus. 2016 Feb 29;5:216. doi: 10.1186/s40064-016-1894-1. PMID: 27026910; PMCID: PMC4771653.
05	Schisandra	*Schisandra chinensis*	Schisandra contains lignans, schisandrin, and various other bioactive compounds that work great for your liver. They promote liver function, decrease inflammation and scarring and work as potent antioxidant to protect your liver from injury.	Chen Q, Zhan Q, Li Y, Sun S, Zhao L, Zhang H, Zhang G. *Schisandra* Lignan Extract Protects against Carbon Tetrachloride-Induced Liver Injury in Mice by Inhibiting Oxidative Stress and Regulating the NF-*κ*B and JNK Signaling Pathways. Evid Based Complement Alternat Med. 2017;2017:5140297. doi: 10.1155/2017/5140297. Epub 2017 Jan 26. PMID: 28246539; PMCID: PMC5299172.

Si.no.	**Local Name**	**Scientific Name**	**Mode of Action used**	***Reference/ Citations***
06	Kutki	*Picrorhiza kurroa*	Picrorhiza consists of iridoid glycosides, kutkin and a lot of other bioactive chemicals renowned for their potential to protect the liver. These chemicals offer antioxidant and anti-inflammatory capabilities while also helping the regeneration of liver tissue. In short they function as a barrier for the live protecting it from injury and supporting its healing process.	Upadhyay D, Anandjiwala S, Padh H, Nivsarkar M. In vitro - In vivo metabolism and pharmacokinetics of picroside I and II using LC-ESI-MS method. Chem Biol Interact. 2016 Jul 25;254:83-92. doi: 10.1016/j.cbi.2016.05.031. Epub 2016 May 24. PMID: 27234049.
07	Indian gooseberry	*Emblica officinalis*	Indian gooseberry is filled with vitamin C, tannins and many bioactive components that act great for your liver. These chemicals are renowned for their antioxidant and anti-inflammatory activities as well as their potential to repair liver cells. In short they provide a barrier for your liver protecting it from harm and assisting in its regeneration.	Yin K, Li X, Luo X, Sha Y, Gong P, Gu J, Tan R. Hepatoprotective Effect and Potential Mechanism of Aqueous Extract from *Phyllanthus emblica* on Carbon-Tetrachloride-Induced Liver Fibrosis in Rats. Evid Based Complement Alternat Med. 2021 Oct 19;2021:5345821. doi: 10.1155/2021/5345821. PMID: 34712342; PMCID: PMC8548103.

Si.no.	**Local Name**	**Scientific Name**	**Mode of Action used**	***Reference/ Citations***
08	Phyllanthus	*Phyllanthus niruri*	Phyllanthus is enriched in lignans, flavonoids, alkaloids and several other bioactive chemicals that are highly useful for liver health. These components shows antioxidant and anti-inflammatory characteristics and also helping in the regeneration of liver tissue. As a result Phyllanthus functions as a protective barrier for the liver protecting it from harm and promoting its healing processes.	Ezzat MI, Okba MM, Ahmed SH, El-Banna HA, Prince A, Mohamed SO, Ezzat SM. In-depth hepatoprotective mechanistic study of Phyllanthus niruri: In vitro and in vivo studies and its chemical characterization. PLoS One. 2020 Jan 15;15(1):e0226185. doi: 10.1371/journal.pone.0226185. PMID: 31940365; PMCID: PMC6961881.

Si.no.	**Local Name**	**Scientific Name**	**Mode of Action used**	***Reference/ Citations***
09	Andrographis	*Andrographis paniculata*	Andrographis is filled with andrographolides and a range of other bioactive chemicals that are renowned for their useful benefits on liver function. These chemicals exhibit antioxidant and anti-inflammatory capabilities as well as helping the regeneration of liver tissue. As a result Andrographis functions as a natural protection for the liver keeping it from injury and assisting in its healing processes.	Mondal M, Sarkar C, Saha S, Hossain MN, Norouzi R, Mubarak MS, Siyadatpanah A, Wilairatana P, Hossain R, Islam MT, Coutinho HDM. Hepatoprotective activity of andrographolide possibly through antioxidative defense mechanism in Sprague-Dawley rats. Toxicol Rep. 2022 Apr 22;9:1013-1022. doi: 10.1016/j.toxrep.2022.04.007. PMID: 36518448; PMCID: PMC9742837.

Si.no.	**Local Name**	**Scientific Name**	**Mode of Action used**	***Reference/ Citations***
10	Bhringraj	*Eclipta prostrata*	Bhringraj is enriched in wedelolactone, ecliptasaponins and numerous other bioactive substances recognized for its positive effects on liver health. These components display antioxidant and anti-inflammatory capabilities as well ashelping in the regeneration of liver cells. As a result Bhringraj functions as a natural barrier for the liver protecting it from injury and helping its healing processes.	Jahan R, Al-Nahain A, Majumder S, Rahmatullah M. Ethnopharmacological Significance of Eclipta alba (L.) Hassk. (Asteraceae). Int Sch Res Notices. 2014 Oct 29;2014:385969. doi: 10.1155/2014/385969. PMID: 27355071; PMCID: PMC4897414.
11	Guduchi	*Tinospora cordifolia*	Guduchi consists of berberine, palmatine and other bioactive substances that are proven to improve liver function. These compounds provide antioxidant, anti-inflammatory and liver-regenerating characteristics effectively insulating the liver from harm and enabling its regeneration.	Sharma V, Pandey D. Protective Role of Tinospora cordifolia against Lead-induced Hepatotoxicity. Toxicol Int. 2010 Jan;17(1):12-7. doi: 10.4103/0971-6580.68343. PMID: 21042467; PMCID: PMC2964743.

Si.no.	**Local Name**	**Scientific Name**	**Mode of Action used**	***Reference/ Citations***
12	Barberry	*Berberis vulgaris*	Barberry consists of berberine and other healthy substances that are beneficial for liver function. These compounds provide antioxidant, anti-inflammatory and liver-regenerating qualities helping to protect the liver from injury and promote its regeneration.	Tahmasebi M, Sadeghi H, Nazem H, Kokhdan EP, Omidifar N. Hepatoprotective effects of *Berberis vulgaris* leaf extract on carbon tetrachloride-induced hepatotoxicity in rats. J Educ Health Promot. 2018 Nov 27;7:147. doi: 10.4103/jehp.jehp_48_17. PMID: 30596119; PMCID: PMC6282695.
13	Licorice	*Glycyrrhiza glabra*	Licorice consists of glycyrrhizin, glycyrrhetinic acid and other useful chemicals that helps liver function. These chemicals contain antioxidant, anti-inflammatory and liver-regenerating capabilities helping to protect the liver from harm and promote its regeneration.	Huo HZ, Wang B, Liang YK, Bao YY, Gu Y. Hepatoprotective and antioxidant effects of licorice extract against CCl_4-induced oxidative damage in rats. Int J Mol Sci. 2011;12(10):6529-43. doi: 10.3390/ijms12106529. Epub 2011 Oct 6. PMID: 22072903; PMCID: PMC3210994.

Si.no.	**Local Name**	**Scientific Name**	**Mode of Action used**	***Reference/ Citations***
14	Greater celandine	*Chelidonium majus*	Greater celandine consists of alkaloids and other helpful substances known to protect the liver. These chemicals demonstrate antioxidant, anti-inflammatory and liver-regenerating characteristics effectively protecting the liver from harm and promoting its repair process.	Pantano F, Mannocchi G, Marinelli E, Gentili S, Graziano S, Busardò FP, di Luca NM. Hepatotoxicity induced by greater celandine (Chelidonium majus L.): a review of the literature. Eur Rev Med Pharmacol Sci. 2017 Mar;21(1 Suppl):46-52. PMID: 28379595.
15	Garden cress	*Lepidium sativum*	Garden cress consists of phenolic compounds, glucosinolates and other bioactive components that actively promote liver health. These substances are recognized for their antioxidant, anti-inflammatory and liver-regenerating qualities effectively insulating the liver from injury and helping in its restoration.	Raish M, Ahmad A, Alkharfy KM, Ahamad SR, Mohsin K, Al-Jenoobi FI, Al-Mohizea AM, Ansari MA. Hepatoprotective activity of Lepidium sativum seeds against D-galactosamine/lipopolysaccharide induced hepatotoxicity in animal model. BMC Complement Altern Med. 2016 Dec 3;16(1):501. doi: 10.1186/s12906-016-1483-4. PMID: 27912738; PMCID: PMC5135812.

Si.no.	**Local Name**	**Scientific Name**	**Mode of Action used**	***Reference/ Citations***
16	Neem	*Azadirachta indica*	Neem is rich in limonoids, flavonoids and other bioactive chemicals that are useful for liver health. These chemicals shows antioxidant and anti-inflammatory activities and help to liver regeneration. As a result neem acts as a natural barrier for the liver protecting it from injury and boosting its healing processes.	Chattopadhyay RR. Possible mechanism of hepatoprotective activity of Azadirachta indica leaf extract: part II. J Ethnopharmacol. 2003 Dec;89(2-3):217-9. doi: 10.1016/j.jep.2003.08.006. PMID: 14611885.
17	Boldo	*Peumus boldus*	Boldo consists of alkaloids, flavonoids and other bioactive components that are helpful for liver function. These chemicals have antioxidant, anti-inflammatory and liver-regenerating characteristics effectively protecting the liver from harm and supporting its repair.	Refaie, A., Shalby, A., Booles, H., Kassem, S., Eshak, M., Farrag, A. R., Khalil, W. Hepatoprotective impact of Boldo (Peumus boldus) extract against azoxystrobin induced DNA damage, gene expression modulation, biochemical and histopathological alterations mediated-ROS generation in male rats. *Egyptian Journal of Chemistry*, 2022; 65(8): 687-698. doi: 10.21608/ejchem.2022.120306.5401

Si.no.	**Local Name**	**Scientific Name**	**Mode of Action used**	***Reference/ Citations***
18	Gentian	*Gentiana lutea*	Gentian consists of iridoids, flavonoids and other bioactive substances that are good for liver protection. These substances provide antioxidant, anti-inflammatory and liver-regenerating effects therefore preserving the liver from harm and helping its repair.	Hamza AA, Gamel M, Abdalla A, Abdalla Y, Amin A. Gentiana lutea attenuates hepatotoxicity induced by ketoconazole in rats by fortifying the cellular antioxidant defense system. J Basic Appl Zool. 2023;84(1):1. doi:10.1186/s41936-022-00321-7.
19	Globe artichoke	*Cynara cardunculus var. scolymus*	Globe artichoke consists of cynarin and other helpful substances that improve liver function. These chemicals promote bile synthesis, improve liver detoxification and exhibit antioxidant and anti-inflammatory activities. As a result globe artichoke helps protect the liver from injury and improves its general well-being.	Aksu Ö, Altınterim B. Hepatoprotective effects of artichoke (Cynara scolymus). doi:10.13140/2.1.1127.9043.

Si.no.	**Local Name**	**Scientific Name**	**Mode of Action used**	***Reference/ Citations***
20	Chicory	*Cichorium intybus*	Chicory consists of sesquiterpene lactones, flavonoids and other bioactive components that are helpful for liver health. These chemicals shows antioxidant, anti-inflammatory and liver-regenerating characteristics effectively protecting the liver from harm and supporting its repair.	Li GY, Gao HY, Huang J, Lu J, Gu JK, Wang JH. Hepatoprotective effect of Cichorium intybus L., a traditional Uighur medicine, against carbon tetrachloride-induced hepatic fibrosis in rats. World J Gastroenterol. 2014 Apr 28;20(16):4753-60. doi: 10.3748/wjg.v20.i16.4753. PMID: 24782629; PMCID: PMC4000513.
21	Aloe vera	*Aloe barbadensis miller*	Aloe vera consists of polysaccharides, vitamins and several other bioactive components that assist liver function. These chemicals shows antioxidant, anti-inflammatory and liver-regenerating characteristics effectively protecting the liver from harm and supporting its repair.	Cui Y, Ye Q, Wang H, Li Y, Yao W, Qian H. Hepatoprotective potential of Aloe vera polysaccharides against chronic alcohol-induced hepatotoxicity in mice. J Sci Food Agric. 2014 Jul;94(9):1764-71. doi: 10.1002/jsfa.6489. Epub 2014 Jan 2. PMID: 24272968.

Si.no.	**Local Name**	**Scientific Name**	**Mode of Action used**	***Reference/ Citations***
22	*Fumitory*	*Fumaria officinalis*	Fumitory is enriched in alkaloids and other bioactive chemicals recognized for their hepatoprotective properties. These chemicals display antioxidant and anti-inflammatory activities as well as helping to liver regeneration. As a result fumitory functions as a natural shield for the liver protecting it from injury and helping in its healing processes.	Sharma UR, Prakash T, Surendra V, Roopakarki, Rao NR, Goli D. Hepatoprotective Activity of Fumaria officinalis against CCl4-induced Liver Damage in Rats. Pharmacologia. 2012;3:9-14. Available from: https://scialert.net/abstract/?doi=pharmacologia.2012.9.14
23	Yellow dock	*Rumex crispus*	Yellow dock consists of anthraquinones, tannins and other bioactive substances that improve liver function. These compounds provide antioxidant, anti-inflammatory and liver-regenerating qualities effectively protecting the liver from harm and helping its repair.	Adamu BA, Emiru YK, Sintayehu B, Araya EM, Periasamy G, Gebrelibanos Hiben M. In vivo Hepatoprotective and in vitro Radical Scavenging Activities of Extracts of *Rumex abyssinicus* Jacq. Rhizome. J Exp Pharmacol. 2020 Aug 5;12:221-231. doi: 10.2147/JEP.S258566. PMID: 32821176; PMCID: PMC7417928.

Si.no.	**Local Name**	**Scientific Name**	**Mode of Action used**	***Reference/ Citations***
24	Rhubarb	*Rheum rhabarbarum*	Rhubarb consists of anthraquinones, tannins and other healthy substances that helps liver function. These chemicals contain antioxidant, anti-inflammatory and liver-regenerating characteristics effectively protecting the liver from harm and helping its repair.	Ibrahim M, Khaja MN, Aara A, Khan AA, Habeeb MA, Devi YP, Narasu ML, Habibullah CM. Hepatoprotective activity of Sapindus mukorossi and Rheum emodi extracts: in vitro and in vivo studies. World J Gastroenterol. 2008 Apr 28;14(16):2566-71. doi: 10.3748/wjg.14.2566. PMID: 18442207; PMCID: PMC2708371.
25	Reishi mushroom	*Ganoderma lucidum*	Reishi mushroom consists of polysaccharides, triterpenes and other bioactive substances that improve liver function. These chemicals shows antioxidant, anti-inflammatory and liver-regenerating characteristics effectively protecting the liver from harm and supporting its repair.	Li A, Shuai X, Jia Z, Li H, Liang X, Su D, Guo W. Ganoderma lucidum polysaccharide extract inhibits hepatocellular carcinoma growth by downregulating regulatory T cells accumulation and function by inducing microRNA-125b. J Transl Med. 2015 Mar 26;13:100. doi: 10.1186/s12967-015-0465-5. PMID: 25889022; PMCID: PMC4379953.

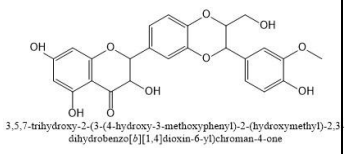
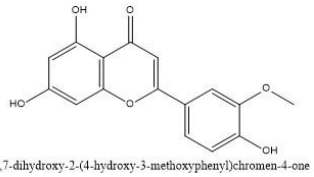
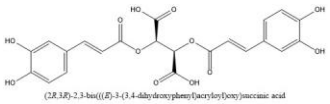
Si.no.	**Local Name**	**Scientific Name**	**Mode of Action used**	***Reference/ Citations***
26	Astragalus	*Astragalus membranaceus*	Astragalus consists of polysaccharides, flavonoids and other useful chemicals that improve liver function. These chemicals shows antioxidant, anti-inflammatory and liver-regenerating characteristics, effectively protecting the liver from harm and helping its repair.	Zhou J, Zhang N, Zhao L, Wu W, Zhang L, Zhou F, Li J. Astragalus Polysaccharides and Saponins Alleviate Liver Injury and Regulate Gut Microbiota in Alcohol Liver Disease Mice. Foods. 2021 Nov 3;10(11):2688. doi: 10.3390/foods10112688. PMID: 34828972; PMCID: PMC8623381.
27	Green Green teatea	*Camellia sinensis*	Green tea consists of catechins, polyphenols and other bioactive substances that improve liver function. These compounds provide antioxidant, anti-inflammatory and liver-regenerating qualities effectively protecting the liver from harm and helping its repair.	Jiao HL, Ye P, Zhao BL. Protective effects of green tea polyphenols on human HepG2 cells against oxidative damage of fenofibrate. Free Radic Biol Med. 2003 Nov 1;35(9):1121-8. doi: 10.1016/s0891-5849(03)00506-9. PMID: 14572614.

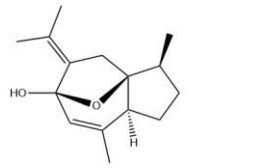
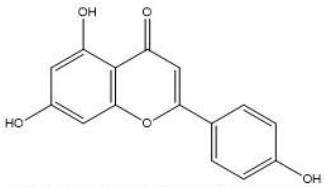
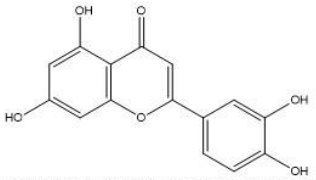
Si.no.	**Local Name**	**Scientific Name**	**Mode of Action used**	***Reference/ Citations***
28	Ginkgo	*Ginkgo biloba*	Ginkgo biloba consists of flavonoids, terpenoids and other bioactive substances that improve liver function. These chemicals shows antioxidant, anti-inflammatory and liver-regenerating characteristics effectively protecting the liver from harm and helping its repair.	Yuan G, Gong Z, Li J, Li X. Ginkgo biloba extract protects against alcohol-induced liver injury in rats. Phytother Res. 2007 Mar;21(3):234-8. doi: 10.1002/ptr.2054. PMID: 17154234.
29	Chinese skullcap	*Scutellaria baicalensis*	Chinese skullcap consists of baicalin, baicalein and other bioactive components that improve liver health. These chemicals shows antioxidant, anti-inflammatory and liver-regenerating characteristics effectively protecting the liver from harm and helping its repair.	Zhou HC, Wang H, Shi K, Li JM, Zong Y, Du R. Hepatoprotective Effect of Baicalein Against Acetaminophen-Induced Acute Liver Injury in Mice. Molecules. 2018 Dec 31;24(1):131. doi: 10.3390/molecules24010131. PMID: 30602693; PMCID: PMC6337302.

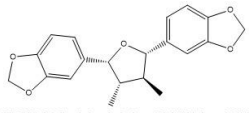
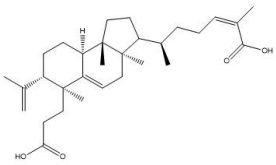
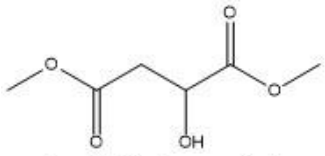
Si.no.	**Local Name**	**Scientific Name**	**Mode of Action used**	***Reference/ Citations***
30	Black seed	*Nigella sativa*	Black seed consists of thymoquinone, thymohydroquinone and nigellone which are considered to protect the liver. Thymoquinone especially has been examined for its antioxidant and anti-inflammatory qualities helping to protect the liver from damage and promoting its restoration.	Mollazadeh H, Hosseinzadeh H. The protective effect of Nigella sativa against liver injury: a review. Iran J Basic Med Sci. 2014 Dec;17(12):958-66. PMID: 25859299; PMCID: PMC4387231.

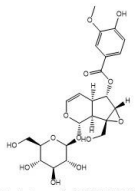
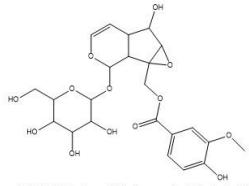
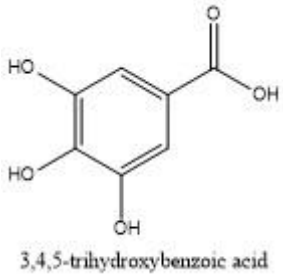
PHYTOCHEMICALS OF THE PLANTS

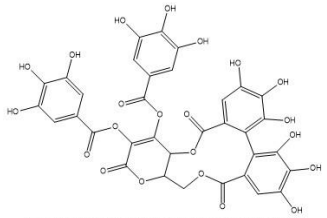
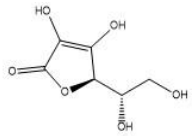
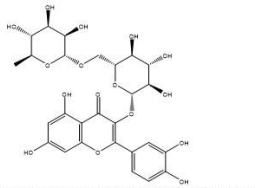
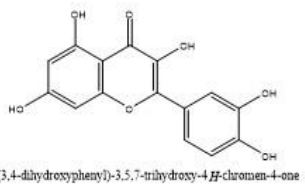
Si.no.	**Local Name**	**Scientific Name**	**Phytochemicals**	***Reference/ Citations***

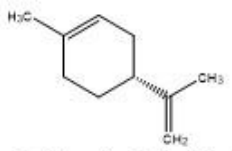
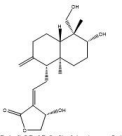
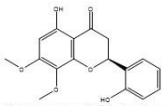
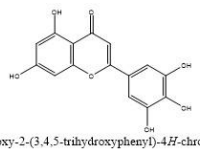
Si.no.	Local Name	Scientific Name	Phytochemicals	***Reference/ Citations***
01	Milk thistle	*Silybum marianum*	It contains the phtochemical Silymarin, which contains flavonolignans such as silybin, silydianin, and silychristin. SILYMARIN:  3,5,7-trihydroxy-2-(3-(4-hydroxy-3-methoxyphenyl)-2-(hydroxymethyl)-2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)chroman-4-one	Aziz M, Saeed F, Ahmad N, Ahmad A, Afzaal M, Hussain S, Mohamed AA, Alamri MS, Anjum FM. Biochemical profile of milk thistle (Silybum Marianum L.) with special reference to silymarin content. Food Sci Nutr. 2020 Nov 9;9(1):244-250. doi: 10.1002/fsn3.1990. PMID: 33473288; PMCID: PMC7802570.
02	Dandelion	*Taraxacum officinale*	Dandelions contains Flavonoids such as chrysoeriol and phenolic acid such as chicoric acid etc. CHRYSOEROIL :  5,7-dihydroxy-2-(4-hydroxy-3-methoxyphenyl)chromen-4-one CHICORIC ACID : 	Bashir S, Peer D. Phytochemistry, biological properties, economic and ecological importance of Taraxacum officinale, A review. 2022 Oct 21. Available From : https://www.researchgate.net/publication/364587974_Phytochemistry_biological_properties_economic_and_ecological_importance_of_Taraxacum_officinale_A_review

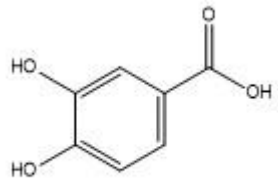
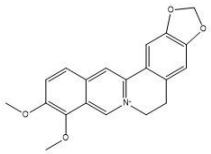
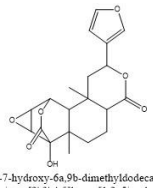
Si.no.	Local Name	Scientific Name	Phytochemicals	***Reference/ Citations***
03	Turmeric	*Curcuma -longa*	Turmeric contains phytochemicals such as Curcumenol :  (3S,3aS,6R,8aS)-3,8-dimethyl-5-(propan-2-ylidene)-1,2,3,4,5,8a-hexahydro-6H-3a,6-epoxyazulen-6-ol	Adinew B. Phytochemistry of turmeric: An overview. Chemistry. 2012 Jan 01;21:888-897. Available from : https://www.researchgate.net/publication/287542565_Phytochemistry_of_turmeric_An_overview
04	Artichoke	*Cynara scolymus*	Artichoke contains polyphenols and flavones such as apigenin and luteolin etc. Apigenin:  5,7-dihydroxy-2-(4-hydroxyphenyl)chromen-4-one Luteolin:  2-(3,4-dihydroxyphenyl)-5,7-dihydroxychromen-4-one	Feiden T, Valduga E, Zeni J, Steffens J. Bioactive Compounds from Artichoke and Application Potential. Food Technol Biotechnol. 2023 Sep;61(3):312-327. doi: 10.17113/ftb.61.03.23.8038. PMID: 38022879; PMCID: PMC10666951.

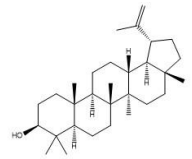
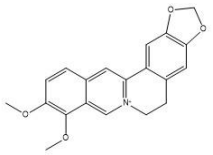
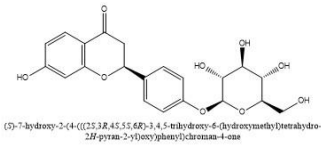
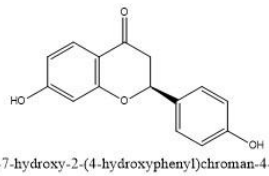
Si.no.	**Local Name**	**Scientific Name**	**Phytochemicals**	***Reference/ Citations***
05	Schisandra	*Schisandra chinensis*	Schisandra contains variety of secondary metabolites such as Lignans, eg :D-epigalbacin:  5,5'-((2*R*,3*S*,4*S*,5*S*)-3,4-dimethyltetrahydrofuran-2,5-diyl)bis(benzo[*d*][1,3]dioxole) Triterpenoids , eg : Kadsuric acid :  (6*R*,*Z*)-6-((3a*R*,6*S*,7*S*,9a*S*,9b*S*)-6-(2-carboxyethyl)-3a,6,9b-trimethyl-7-(prop-1-en-2-yl)-2,3,3a,4,6,7,8,9,9a,9b-decahydro-1*H*-cyclopenta[*a*]naphthalen-3-yl)-2-methylhept-2-enoic acid Fatty acids , eg : Dimethyl-malate :  dimethyl 2-hydroxysuccinate	Yang S, Yuan C. Schisandra chinensis: A comprehensive review on its phytochemicals and biological activities. Arabian J Chem. 2021;14(9):103310. doi:10.1016/j.arabjc.2021.103310. Available from: https://www.sciencedirect.com/science/article/pii/S1878535221003257

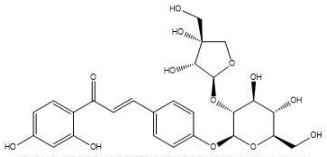
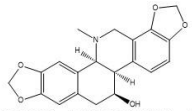
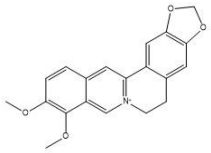
Si.no.	Local Name	Scientific Name	Phytochemicals	***Reference/ Citations***
06	Kutki	*Picrorhiza kurroa*	Picrorhiza kurroa contains phytochemicals such as Picroside II :  (1a*S*,1b*S*,2*S*,5a*R*,6*S*,6a*S*)-1a-(hydroxymethyl)-2-(((2*S*,3*R*,4*S*,5*S*,6*R*)-3,4,5-trihydroxy-6-(hydroxymethyl)tetrahydro-2*H*-pyran-2-yl)oxy)-1a,1b,2,5a,6,6a-hexahydrooxireno[2',3':4,5]cyclopenta[1,2-*c*]pyran-6-yl 4-hydroxy-3-methoxybenzoate kutkoside :  (6-hydroxy-2-((3,4,5-trihydroxy-6-(hydroxymethyl)tetrahydro-2*H*-pyran-2-yl)oxy)-1b,5a,6,6a-tetrahydrooxireno[2',3':4,5]cyclopenta[1,2-*c*]pyran-1a(2*H*)-yl)methyl 4-hydroxy-3-methoxybenzoate	Almeleebia TM, Alsayari A, Wahab S. Pharmacological and Clinical Efficacy of *Picrorhiza kurroa* and Its Secondary Metabolites: A Comprehensive Review. Molecules. 2022 Nov 29;27(23):8316. doi: 10.3390/molecules27238316. PMID: 36500409; PMCID: PMC9738980.
07	Indian gooseberry	*Emblica officinalis*	Indian gooseberry contains phytochemical such as Gallic acid :  3,4,5-trihydroxybenzoic acid Emblicanin A :	Gul M, Liu ZW, Iahtisham-Ul-Haq, Rabail R, Faheem F, Walayat N, Nawaz A, Shabbir MA, Munekata PES, Lorenzo JM, Aadil RM. Functional and Nutraceutical Significance of Amla (*Phyllanthus emblica* L.): A Review. Antioxidants (Basel). 2022 Apr 22;11(5):816. doi: 10.3390/antiox11050816. PMID: 35624683; PMCID: PMC9137578. Husain I, Akhtar M, Madaan T, Vohora D, Abdin MZ, Islamuddin M, Najmi AK. Tannins Enriched Fraction of *Emblica officinalis* Fruits Alleviates High-Salt and Cholesterol Diet-Induced Cognitive

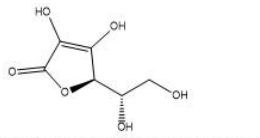
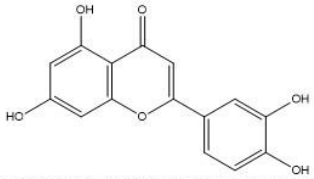
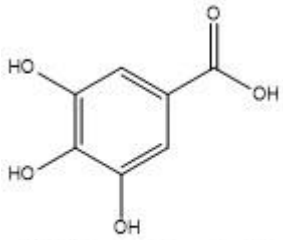
Si.no.	Local Name	Scientific Name	Phytochemicals	***Reference/ Citations***
			 2,3,4,5,6,7-hexahydroxy-9,13,17-trioxo-9,11,11a,13,15a,17-hexahydrodibenzo[*g*,*j*]pyrano[3,2-*b*][1,5]dioxacycloundecine-14,15-diyl bis(3,4,5-trihydroxybenzoate) Ascorbic acid :  (*R*)-5-((*S*)-1,2-dihydroxyethyl)-3,4-dihydroxyfuran-2(5*H*)-one	Impairment in Rats via Nrf2-ARE Pathway. Front Pharmacol. 2018 Jan 30;9:23. doi: 10.3389/fphar.2018.00023. PMID: 29441016; PMCID: PMC5797548.
08	Phyllanthus	*Phyllanthus niruri*	Phyllanthus contains phytochemicals such as Rutin :  2-(3,4-dihydroxyphenyl)-5,7-dihydroxy-3-(((2*S*,3*R*,4*S*,5*S*,6*R*)-3,4,5-trihydroxy-6-(((((2*R*,3*R*,4*R*,5*R*,6*S*)-3,4,5-trihydroxy-6-methyltetrahydro-2*H*-pyran-2-yl)oxy)methyl)tetrahydro-2*H*-pyran-2-yl)oxy)-4*H*-chromen-4-one Quercetin :  2-(3,4-dihydroxyphenyl)-3,5,7-trihydroxy-4*H*-chromen-4-one Limonene :	Bagalkotkar G, Sagineedu SR, Saad MS, Stanslas J. Phytochemicals from Phyllanthus niruri Linn. and their pharmacological properties: a review. J Pharm Pharmacol. 2006 Dec;58(12):1559-70. doi: 10.1211/jpp.58.12.0001. PMID: 17331318.

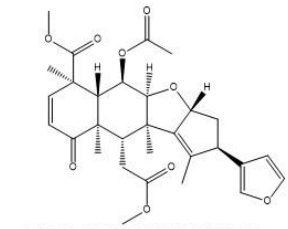
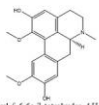
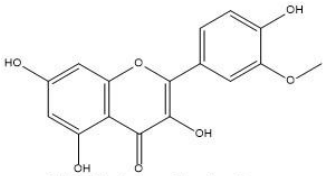
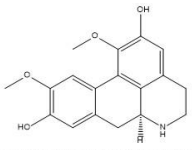
Si.no.	Local Name	Scientific Name	Phytochemicals	***Reference/ Citations***
			 (*R*)-1-methyl-4-(prop-1-en-2-yl)cyclohex-1-ene	
09	Andrographis	*Andrographis paniculata*	Andrographis contains phytochemicals such as Andrographolide :  (*S*,*E*)-4-hydroxy-3-(2-((1*R*,4a*S*,5*R*,6*R*,8a*S*)-6-hydroxy-5-(hydroxymethyl)-5,8a-dimethyl-2-methylenedecahydronaphthalen-1-yl)ethylidene)dihydrofuran-2(3*H*)-one Dihydroskullcapflavone :  (*S*)-5-hydroxy-2-(2-hydroxyphenyl)-7,8-dimethoxychroman-4-one	Okhuarobo A, Falodun JE, Erharuyi O, Imieje V, Falodun A, Langer P. Harnessing the medicinal properties of *Andrographis paniculata* for diseases and beyond: a review of its phytochemistry and pharmacology. Asian Pac J Trop Dis. 2014 Jun;4(3):213–22. doi: 10.1016/S2222-1808(14)60509-0. PMCID: PMC4032030.
10	Bhringraj	*Eclipta prostrata*	Eclipta prostrata contains phytochemicals such as Tricetin :  5,7-dihydroxy-2-(3,4,5-trihydroxyphenyl)-4*H*-chromen-4-one Protocatechuic acid :	Timalsina D, Devkota HP. *Eclipta prostrata* (L.) L. (Asteraceae): Ethnomedicinal Uses, Chemical Constituents, and Biological Activities. Biomolecules. 2021 Nov 22;11(11):1738. doi: 10.3390/biom11111738. PMID: 34827736; PMCID: PMC8615741.

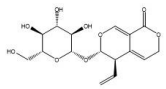
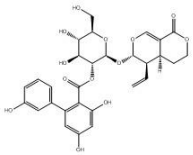
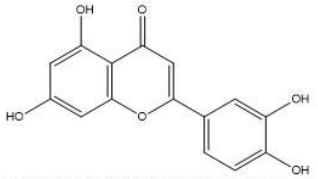
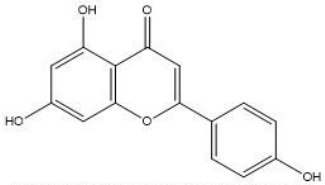
Si.no.	Local Name	Scientific Name	Phytochemicals	***Reference/ Citations***
			 3,4-dihydroxybenzoic acid	
11	Guduchi	*Tinospora cordifolia*	Guduchi contains phytochemical compounds such as Berberine :  9,10-dimethoxy-5,6-dihydro-[1,3]dioxolo[4,5-*g*]isoquinolino[3,2-*a*]isoquinolin-7-ium Tinosporides :  2-(furan-3-yl)-7-hydroxy-6a,9b-dimethyldodecahydro-4*H*-9,7-(epoxymethano)oxireno[2',3':4,5]benzo[1,2-*f*]isochromene-4,11-dione	Gupta A, Gupta P, Bajpai G. *Tinospora cordifolia (Giloy)*: An insight on the multifarious pharmacological paradigms of a most promising medicinal ayurvedic herb. Heliyon. 2024 Feb 15;10(4):e26125. doi: 10.1016/j.heliyon.2024.e26125. PMID: 38390130; PMCID: PMC10882059.
12	Barberry	*Berberis vulgaris*	Barberry contains phytochemicals such as Lupeol : 	Mokhber-Dezfuli N, Saeidnia S, Gohari AR, Kurepaz-Mahmoodabadi M. Phytochemistry and pharmacology of berberis species. Pharmacogn Rev. 2014 Jan;8(15):8-15. doi: 10.4103/0973-7847.125517. PMID: 24600191; PMCID:

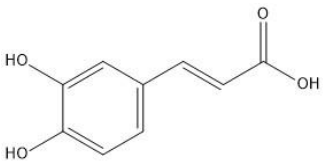
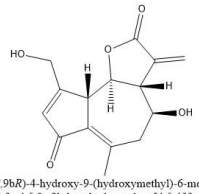
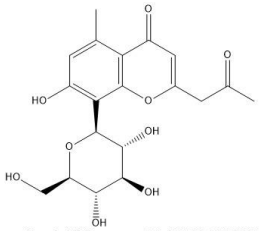
Si.no.	Local Name	Scientific Name	Phytochemicals	***Reference/ Citations***
			 (1*R*,3a*R*,5a*R*,5b*R*,7a*R*,9*S*,11a*R*,11b*R*,13a*R*,13b*R*)-3a,5a,5b,8,8,11a-hexamethyl-1-(prop-1-en-2-yl)icosahydro-1*H*-cyclopenta[*a*]chrysen-9-ol Berberine :  9,10-dimethoxy-5,6-dihydro-[1,3]dioxolo[4,5-*g*]isoquinolino[3,2-*a*]isoquinolin-7-ium	PMC3931204.
13	Licorice	*Glycyrrhiza glabra*	Glycyrrhiza glabra contains phytochemicals such as Liquiritin :  (*S*)-7-hydroxy-2-(4-(((2*S*,3*R*,4*S*,5*S*,6*R*)-3,4,5-trihydroxy-6-(hydroxymethyl)tetrahydro-2*H*-pyran-2-yl)oxy)phenyl)chroman-4-one Liquiritigenin :  (*S*)-7-hydroxy-2-(4-hydroxyphenyl)chroman-4-one Isoliquiritin apioside :	Gil G, Sharifi-Rad J, Quispe C, Herrera-Bravo J, Belén LH, Kaur R, Kregiel D, Uprety Y, Beyatli A, Yeskaliyeva B, Kırkın C, Özçelik B, Sen S, Acharya K, Sharopov F, Cruz-Martins N, Kumar M, Razis AFA, Sunusi U, Kamal RM, Shaheen S, Suleria HARS. Glycyrrhiza Genus: Enlightening Phytochemical Components for Pharmacological and Health-Promoting Abilities. Oxid Med Cell Longev. 2021;2021:7571132. doi:10.1155/2021/7571132.

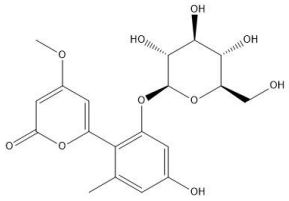
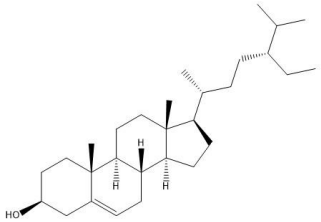
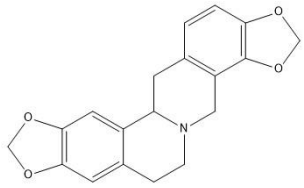
Si.no.	Local Name	Scientific Name	Phytochemicals	***Reference/ Citations***
			 (*E*)-3-(4-(((2*S*,3*R*,4*S*,5*S*,6*R*)-3-(((2*S*,3*R*,4*R*)-3,4-dihydroxy-4-(hydroxymethyl)tetrahydrofuran-2-yl)oxy)-4,5-dihydroxy-6-(hydroxymethyl)tetrahydro-2*H*-pyran-2-yl)oxy)phenyl)-1-(2,4-dihydroxyphenyl)prop-2-en-1-one	
14	Greater celandine	*Chelidonium majus*	*Chelidonium majus* contains phytochemicals such as Chelidonine :  (5b*R*,6*S*,12b*S*)-13-methyl-5b,6,7,12b,13,14-hexahydro-[1,3]dioxolo[4',5':4,5]benzo[1,2-*c*][1,3]dioxolo[4,5-*j*]phenanthridin-6-ol Berberine :  9,10-dimethoxy-5,6-dihydro-[1,3]dioxolo[4,5-*g*]isoquinolino[3,2-*a*]isoquinolin-7-ium	Krizhanovska V, Sile I, Kronberga A, Nakurte I, Mezaka I, Dambrova M, Pugovics O, Grinberga S. The Cultivation of *Chelidonium majus* L. Increased the Total Alkaloid Content and Cytotoxic Activity Compared with Those of Wild-Grown Plants. Plants (Basel). 2021 Sep 21;10(9):1971. doi: 10.3390/plants10091971. PMID: 34579502; PMCID: PMC8467419.

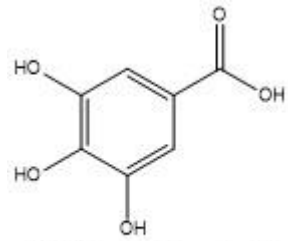
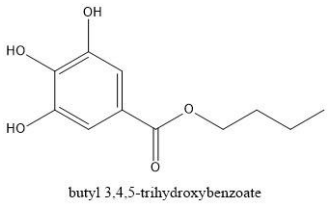
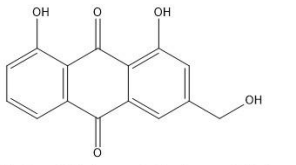
Si.no.	Local Name	Scientific Name	Phytochemicals	***Reference/ Citations***
15	Garden cress	*Lepidium sativum*	*Lepidium sativum contains phytochemicals such as* Ascorbic acid :  (*R*)-5-((*S*)-1,2-dihydroxyethyl)-3,4-dihydroxyfuran-2(5*H*)-one Luteolin:  2-(3,4-dihydroxyphenyl)-5,7-dihydroxychromen-4-one	Painuli S, Quispe C, Herrera-Bravo J, Semwal P, Martorell M, Almarhoon ZM, Seilkhan A, Ydyrys A, Rad JS, Alshehri MM, Daştan SD, Taheri Y, Calina D, Cho WC. Nutraceutical Profiling, Bioactive Composition, and Biological Applications of *Lepidium sativum* L. Oxid Med Cell Longev. 2022 Jan 19;2022:2910411. doi: 10.1155/2022/2910411. PMID: 35096265; PMCID: PMC8791756.
16	Neem	*Azadirachta indica*	*Azadirachta indica* phytochemicals such as Gallic acid :  3,4,5-trihydroxybenzoic acid Nimbin :	Maji S, Modak S. Neem: Treasure of Natural Phytochemicals. Chem Sci Rev. 2021 Sep 30;10:396-401. doi:10.37273/chesci.cs205205351.

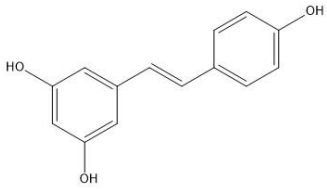
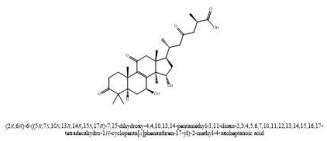
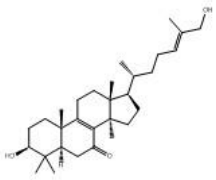
Si.no.	Local Name	Scientific Name	Phytochemicals	***Reference/ Citations***
			 methyl (2*R*,3a*R*,4a*S*,5*R*,5a*R*,6*R*,9a*R*,10*S*,10a*R*)-5-acetoxy-2-(furan-3-yl)-10-(2-methoxy-2-oxoethyl)-1,6,9a,10a-tetramethyl-9-oxo-3,3a,4a,5,5a,6,9,9a,10,10a-decahydro-2*H*-cyclopenta[*b*]naphtho[2,3-*d*]furan-6-carboxylate	
17	Boldo	*Peumus boldus*	Peumus boldus contains phytochemicals such as Boldine :  (*S*)-1,10-dimethoxy-6-methyl-5,6,6a,7-tetrahydro-4*H*-dibenzo[*de*,*g*]quinoline-2,9-diol Isorhamnetin :  3,4',5,7-Tetrahydroxy-3'-methoxyflavone Laurolitsine :  (*S*)-1,10-dimethoxy-5,6,6a,7-tetrahydro-4*H*-dibenzo[*de*,*g*]quinoline-2,9-diol	Elsaid Abouelela M, Elgindi O. Boldo phytochemical and pharmacological activities: updated Mini-review. Available From :https://www.researchgate.net/publication/370266869_Boldo_phytochemical_and_pharmacological_activities_updated_Mini-review

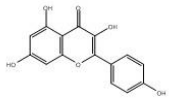
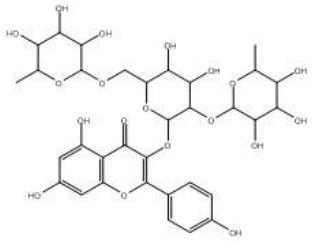
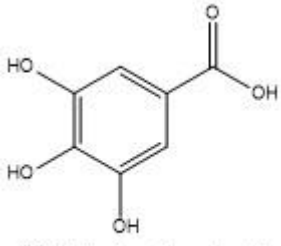
Si.no.	Local Name	Scientific Name	Phytochemicals	***Reference/ Citations***
18	Gentian	*Gentiana lutea*	Gentiana lutea contains phytochemical such as Gentiopicroside :  (5*R*,6*S*)-6-(((2*S*,3*R*,4*S*,5*S*,6*R*)-3,4,5-trihydroxy-6-(hydroxymethyl)tetrahydro-2*H*-pyran-2-yl)oxy)-5-vinyl-5,6-dihydro-1*H*,3*H*-pyrano[3,4-*c*]pyran-1-one Amarogentin :  (2*S*,3*R*,4*S*,5*S*,6*R*)-4,5-dihydroxy-6-(hydroxymethyl)-2-(((4a*S*,5*R*,6*S*)-1-oxo-5-vinyl-4,4a,5,6-tetrahydro-1*H*,3*H*-pyrano[3,4-*c*]pyran-6-yl)oxy)tetrahydro-2*H*-pyran-3-yl 3,3',5-trihydroxy-[1,1'-biphenyl]-2-carboxylate	Mirzaee F, Hosseini A, Jouybari HB, Davoodi A, Azadbakht M. Medicinal, biological and phytochemical properties of Gentiana species. J Tradit Complement Med. 2017 Jan 28;7(4):400-408. doi: 10.1016/j.jtcme.2016.12.013. PMID: 29034186; PMCID: PMC5634738.
19	Globe artichoke	*Cynara carduncu lus var. scolymus*	Globe artichoke contains phytochemicals such as Luteolin:  2-(3,4-dihydroxyphenyl)-5,7-dihydroxychromen-4-one Apigenin:  5,7-dihydroxy-2-(4-hydroxyphenyl)chromen-4-one	Feiden T, Valduga E, Zeni J, Steffens J. Bioactive Compounds from Artichoke and Application Potential. Food Technol Biotechnol. 2023 Sep;61(3):312-327. doi: 10.17113/ftb.61.03.23.8038. PMID: 38022879; PMCID: PMC10666951.

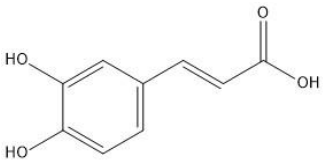
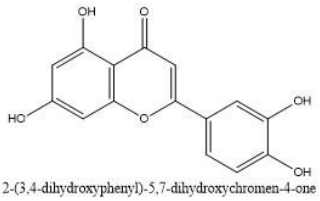
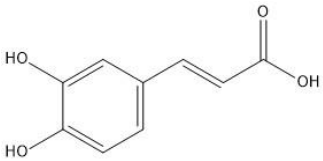
Si.no.	Local Name	Scientific Name	Phytochemicals	***Reference/ Citations***
20	Chicory	*Cichorium intybus*	*Cichorium intybus* contains phytochemicals such as Caffeic acid :  (*E*)-3-(3,4-dihydroxyphenyl)acrylic acid Lactucin :  (3a*R*,4*S*,9a*S*,9b*R*)-4-hydroxy-9-(hydroxymethyl)-6-methyl-3-methylene-3,3a,4,5,9a,9b-hexahydroazuleno[4,5-*b*]furan-2,7-dione	Street RA, Sidana J, Prinsloo G. Cichorium intybus: Traditional Uses, Phytochemistry, Pharmacology, and Toxicology. Evid Based Complement Alternat Med. 2013;2013:579319. doi: 10.1155/2013/579319. Epub 2013 Nov 26. PMID: 24379887; PMCID: PMC3860133.
21	Aloe vera	*Aloe barbadensis miller*	Aloe Vera contain phytochemicals such as Aloesin :  7-hydroxy-5-methyl-2-(2-oxopropyl)-8-((2*S*,3*R*,4*R*,5*S*,6*R*)-3,4,5-trihydroxy-6-(hydroxymethyl)tetrahydro-2*H*-pyran-2-yl)-4*H*-chromen-4-one Aloenin : 	Nalimu F, Oloro J, Kahwa I, Ogwang PE. Review on the phytochemistry and toxicological profiles of *Aloe vera* and *Aloe ferox*. Futur J Pharm Sci. 2021;7(1):145. doi: 10.1186/s43094-021-00296-2. Epub 2021 Jul 21. PMID: 34307697; PMCID: PMC8294304.

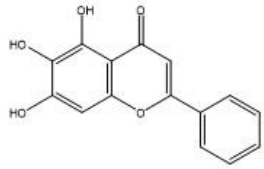
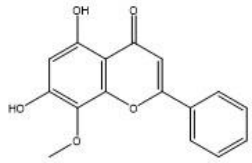
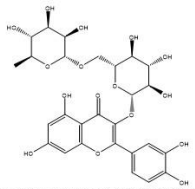
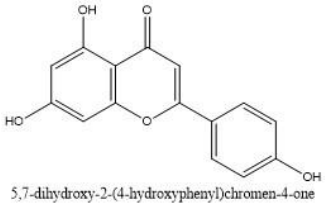
Si.no.	Local Name	Scientific Name	Phytochemicals	***Reference/ Citations***
			 6-(4-hydroxy-2-methyl-6-(((2*S*,3*R*,4*S*,5*S*,6*R*)-3,4,5-trihydroxy-6-(hydroxymethyl)tetrahydro-2*H*-pyran-2-yl)oxy)phenyl)-4-methoxy-2*H*-pyran-2-one	
22	*Fumitory*	*Fumaria officinalis*	Fumitory contains phytochemicals such as Sitosterol :  (3*S*,8*S*,9*S*,10*R*,13*R*,14*S*,17*R*)-17-((2*R*,5*R*)-5-ethyl-6-methylheptan-2-yl)-10,13-dimethyl-2,3,4,7,8,9,10,11,12,13,14,15,16,17-tetradecahydro-1*H*-cyclopenta[*a*]phenanthren-3-ol Tetrahydrocoptisine :  6,7,12b,13-tetrahydro-4*H*-[1,3]dioxolo[4',5':7,8]isoquinolino[3,2-*a*][1,3]dioxolo[4,5-*g*]isoquinoline	Gupta PC, Sharma N, Rao ChV. A review on ethnobotany, phytochemistry and pharmacology of Fumaria indica (Fumitory). Asian Pac J Trop Biomed. 2012 Aug;2(8):665-9. doi: 10.1016/S2221-1691(12)60117-8. PMID: 23569991; PMCID: PMC3609363.

Si.no.	Local Name	Scientific Name	Phytochemicals	***Reference/ Citations***
23	Yellow dock	*Rumex crispus*	Rumex crispus contains phytochemicals such as Gallic acid  3,4,5-trihydroxybenzoic acid : Butyl gallate :  butyl 3,4,5-trihydroxybenzoate	Saoudi MM, Bouajila J, Rahmani R, Alouani K. Phytochemical Composition, Antioxidant, Antiacetylcholinesterase, and Cytotoxic Activities of *Rumex crispus* L. Int J Anal Chem. 2021 Jul 2;2021:6675436. doi: 10.1155/2021/6675436. PMID: 34306086; PMCID: PMC8272662.
24	Rhubarb	*Rheum rhabarbarum*	Rheum rhabarbarum contains phytochemicals such as Aloe-emodin :  1,8-dihydroxy-3-(hydroxymethyl)anthracene-9,10-dione Resveratrol :	KHATTAK AK, HASSAN SM, MUGHAL SS. GENERAL OVERVIEW OF PHYTOCHEMISTRY AND PHARMACOLOGICAL POTENTIAL OF RHEUM PALMATUM (CHINESE RHUBARB). Innovare J Ay Sci [Internet]. 2020 Nov. 1 [cited 2024 May 7];8(6):5-9. Available from: https://journals.innovareacademics.in/index.php/ijas/article/view/39192

Si.no.	Local Name	Scientific Name	Phytochemicals	***Reference/ Citations***
			 (*E*)-5-(4-hydroxystyryl)benzene-1,3-diol	
25	Reishi mushroom	*Ganoderma lucidum*	Ganoderma lucidum contains phytochemicals such as Ganoderic acid A :  Lucidadiol :  (3*S*,5*R*,10*S*,13*R*,14*R*,17*R*)-3-hydroxy-17-((*R*,*E*)-7-hydroxy-6-methylhept-5-en-2-yl)-4,4,10,13,14-pentamethyl-1,2,3,4,5,6,10,11,12,13,14,15,16,17-tetradecahydro-7*H*-cyclopenta[*a*]phenanthren-7-one	Wu S, Zhang S, Peng B, Tan D, Wu M, Wei J, Wang Y, Luo H. Ganoderma lucidum: a comprehensive review of phytochemistry, efficacy, safety and clinical study. Food Sci Hum Wellness. 2024 Mar 1;13(2):568-596. Available from: https://doi.org/10.26599/FSHW.2022.9250051

Si.no.	Local Name	Scientific Name	Phytochemicals	***Reference/ Citations***
26	Astragalus	*Astragalus membranaceus*	Astragalus membranaceus contains phytochemicals such as Kaempferol :  3,5,7-trihydroxy-2-(4-hydroxyphenyl)-4*H*-chromen-4-one Mauritianin :  3-((4,5-dihydroxy-3-((3,4,5-trihydroxy-6-methyltetrahydro-2*H*-pyran-2-yl)oxy)-6-(((3,4,5-trihydroxy-6-methyltetrahydro-2*H*-pyran-2-yl)oxy)methyl)tetrahydro-2*H*-pyran-2-yl)oxy)-5,7-dihydroxy-2-(4-hydroxyphenyl)-4*H*-chromen-4-one	Bratkov VM, Shkondrov AM, Zdraveva PK, Krasteva IN. Flavonoids from the Genus Astragalus: Phytochemistry and Biological Activity. Pharmacogn Rev. 2016 Jan-Jun;10(19):11-32. doi: 10.4103/0973-7847.176550. PMID: 27041870; PMCID: PMC4791984.
27	Green tea	*Camellia sinensis*	Camellia sinensis contains phytochemicals such as Gallic Acid  3,4,5-trihydroxybenzoic acid : Caffeic Acid	Zhao T, Li C, Wang S, Song X. Green Tea (*Camellia sinensis*): A Review of Its Phytochemistry, Pharmacology, and Toxicology. Molecules. 2022 Jun 18;27(12):3909. doi: 10.3390/molecules27123909. PMID: 35745040; PMCID: PMC9231383.

Si.no.	Local Name	Scientific Name	Phytochemicals	***Reference/ Citations***
			:  (*E*)-3-(3,4-dihydroxyphenyl)acrylic acid	
28	Ginkgo	*Ginkgo biloba*	Ginko biloba contains phytochemicals such as Luteolin :  2-(3,4-dihydroxyphenyl)-5,7-dihydroxychromen-4-one Caffeic Acid :  (*E*)-3-(3,4-dihydroxyphenyl)acrylic acid	Noor-E-Tabassum, Das R, Lami MS, Chakraborty AJ, Mitra S, Tallei TE, Idroes R, Mohamed AA, Hossain MJ, Dhama K, Mostafa-Hedeab G, Emran TB. *Ginkgo biloba*: A Treasure of Functional Phytochemicals with Multimedicinal Applications. Evid Based Complement Alternat Med. 2022 Feb 28;2022:8288818. doi: 10.1155/2022/8288818. PMID: 35265150; PMCID: PMC8901348.
29	Chinese skullcap	*Scutellaria baicalensis*	Scutellaria baicalensis contains phytochemicals such as Baicalein : 	Chanchal DK, Singh K, Bhushan B, Chaudhary JS, Kumar S, Varma AK, Agnihotri N, Garg A. An updated review of Chinese skullcap (Scutellaria baicalensis): Emphasis on phytochemical constituents and pharmacological attributes. Pharmacol Res - Mod Chin Med. 2023;9:100326.

Si.no.	Local Name	Scientific Name	Phytochemicals	***Reference/ Citations***
			 5,6,7-trihydroxy-2-phenyl-4*H*-chromen-4-one Wogonin :  5,7-dihydroxy-8-methoxy-2-phenyl-4*H*-chromen-4-one	doi: 10.1016/j.prmcm.2023.100326. https://doi.org/10.1016/j.prmcm.2023.100326
30	Black seed	*Nigella sativa*	Nigella sativa contains phytochemicals such as Rutin :  2-(3,4-dihydroxyphenyl)-5,7-dihydroxy-3-(((2*S*,3*R*,4*S*,5*S*,6*R*)-3,4,5-trihydroxy-6-((((2*R*,3*R*,4*R*,5*R*,6*S*)-3,4,5-trihydroxy-6-methyltetrahydro-2*H*-pyran-2-yl)oxy)methyl)tetrahydro-2*H*-pyran-2-yl)oxy)-4*H*-chromen-4-one Apigenin :  5,7-dihydroxy-2-(4-hydroxyphenyl)chromen-4-one	Dalli M, Bekkouch O, Azizi SE, Azghar A, Gseyra N, Kim B. *Nigella sativa* L. Phytochemistry and Pharmacological Activities: A Review (2019-2021). Biomolecules. 2021 Dec 23;12(1):20. doi: 10.3390/biom12010020. PMID: 35053168; PMCID: PMC8773974.

THE SIDE EFFECTS

SI NO.	PLANT NAME	SIDE EFFECT	REFERENCE/CITATIONS
01	MILK THISTLE	Nausea, Diarrhea, Headache, Changes in bowel habits , Rash, Insomnia etc.	Mulrow C, Lawrence V, Jacobs B, et al. Milk Thistle: Effects on Liver Disease and Cirrhosis and Clinical Adverse Effects: Summary. 2000. In: AHRQ Evidence Report Summaries. Rockville (MD): Agency for Healthcare Research and Quality (US); 1998-2005. 21. Available from: https://www.ncbi.nlm.nih.gov/books/NBK11896/
02	DANDELION	Might cause Mild diarrhoea or Gastritis.	Hempen CH, Fischer T. IV - Herbs that cool heat. In: Hempen CH, Fischer T, editors. A Materia Medica for Chinese Medicine. Churchill Livingstone; 2009. p. 110-263. ISBN 9780443100949. doi:10.1016/B978-0-443-10094-9.00007-8.
03	TURMERIC	Certain allergic reactions, nausea and diarrhea.	Drugs and Lactation Database (LactMed®) [Internet]. Bethesda (MD): National Institute of Child Health and Human Development; 2006–. Turmeric. 2023 Nov 15. PMID: 30000906.

SI NO.	PLANT NAME	SIDE EFFECT	REFERENCE/CITATIONS
04	ARTICHOKE	Dizziness, Dehydration, Constipation,Drowsiness etc.	Amini MR, Sheikhhossein F, Alvani M, Shoura SMS, Sohrabnavi A, Heidarian E, Hekmatdoost A. Anti-hypertensive Effects of Artichoke Supplementation in Adults: A Systematic Review and Dose-response Meta-analysis of Randomized Controlled Trials. Clin Nutr Res. 2022 Jul 26;11(3):214-227. doi: 10.7762/cnr.2022.11.3.214. PMID: 35949557; PMCID: PMC9348915.
05	SCHISANDRA	Urticaria , Indigestion, Anorexia etc.	St. John TM. Chapter 21 - Chronic Hepatitis. In: Rakel D, editor. Integrative Medicine (Fourth Edition). Elsevier; 2018. p. 198-210.e5. doi:10.1016/B978-0-323-35868-2.00021-9.
06	KUTKI	Abdominal colic, Diarrhoea, Abdominal gurgling etc.	Raut A, Dhami-Shah H, Phadke A, Shindikar A, Udipi S, Joshi J, Vaidya R, Vaidya ADB. Picrorhiza kurroa, Royle ex Benth:Traditional uses, phytopharmacology, and translational potential in therapy of fatty liver disease. J Ayurveda Integr Med. 2023 Jan-Feb;14(1):100558. doi: 10.1016/j.jaim.2022.100558. Epub 2022 Jun 2. PMID: 35659739; PMCID: PMC10105242.
07	INDIAN GOOSEBERRY	Gastrointestinal problems such as bloating and diarrhea Blood sugar levels can drop too low	https://www.medicinenet.com/indian_gooseberry_benefits_uses_and_side_effects/article.htm

SI NO.	PLANT NAME	SIDE EFFECT	REFERENCE/CITATIONS
08	PHYLLANTHUS NIRURI	Painful urination , Nausea ,Abdominal pain etc.	https://www.webmd.com/diet/health-benefits-chanca-piedra
09	ANDROGRAPHIS PANICULATA	Might cause Nausea , Vomiting, diarrhea, chest pain, rash etc.	Kaewdech A, Nawalerspanya S, Assawasuwannakit S, Chamroonkul N, Jandee S, Sripongpun P. The use of Andrographis paniculata and its effects on liver biochemistry of patients with gastrointestinal problems in Thailand during the COVID-19 pandemic: a cross sectional study. Sci Rep. 2022 Oct 29;12(1):18213. doi: 10.1038/s41598-022-23189-7. PMID: 36309577; PMCID: PMC9617865.
10	BHRINGRAJ	Frequent urination Nausea Vision changes	https://www.verywellhealth.com/the-benefits-of-bhringaraj-oil-88825
11	GUDUCHI	People who consume too much of it develop constipation. Consuming excess amount of it can overstimulate immune system and cause problems	https://www.godigit.com/nutrition/benefits-of-guduchi#:~:text=Although%20Guduchi%20has%20no%20significant,much%20of%20it%20develop%20constipation.
12	BARBERRY	Ulceration, Immunotoxicity, Neurotoxicity, Cardiotoxicity and Jaundice	Rad SZK, Rameshrad M, Hosseinzadeh H. Toxicology effects of *Berberis vulgaris* (barberry) and its active constituent, berberine: a review. Iran J Basic Med Sci. 2017 May;20(5):516-529. doi: 10.22038/IJBMS.2017.8676. PMID:

SI NO.	PLANT NAME	SIDE EFFECT	REFERENCE/CITATIONS
			28656087; PMCID: PMC5478780.
13	LICORICE	Might increase the risk of premature birth,hypokalemia and high blood pressure.	Icer M. A Review: Pharmacological Effects of Licorice (Glycyrrhiza glabra) on Human Health. 2017 Jan 01;12. [Abstract] Available from: [https://www.researchgate.net/publication/343046456_A_Review_Pharmacological_Effects_of_Licorice_Glycyrrhiza_glabra_on_Human_Health]
14	GREATER CELANDINE	Weakness, Nausea, Vomiting, Abdominal Pain, Itching etc.	Teschke R, Frenzel C, Glass X, Schulze J, Eickhoff A. Greater Celandine hepatotoxicity: a clinical review. Ann Hepatol. 2012;11(6):838-848. doi:10.1016/S1665-2681(19)31408-5.
15	GARDEN CRESS	If consumed in large amount it can cause the thyroid gland to enlarge which might lead to goitre and hypothyroidism.	https://www.nairaland.com/5462943/15-health-benefits-garden-cress
16	NEEM	Consuming neem extracts during pregnancy might cause miscarriage.	https://www.medicinenet.com/what_is_neem_extract/article.htm

SI NO.	PLANT NAME	SIDE EFFECT	REFERENCE/CITATIONS
17	BOLDO	High dosages of boldo might harm the kidneys due to the presence of the volatile oil and must be avoided by individuals with an existing renal condition.	Yang L, Li X, Sherali AR, Geary DF, Schaefer F. CHAPTER 67 - Nephrotoxicity of Herbal Remedies. In: Geary DF, Schaefer F, editors. Comprehensive Pediatric Nephrology. Philadelphia: Mosby; 2008. p. 1027-1043. doi: https://doi.org/10.1016/B978-0-323-04883-5.50073-8. Available from: https://www.sciencedirect.com/science/article/pii/B9780323048835500738
18	GENTIANA LUTEA	High or excess dose might cause gastric irritation which might result in nausea and vomiting.	https://www.herbal-supplement-resource.com/gentian-root.html
19	GLOBE ARTICHOKE	Dizziness, Dehydration, Constipation,Drowsiness etc.	Amini MR, Sheikhhossein F, Alvani M, Shoura SMS, Sohrabnavi A, Heidarian E, Hekmatdoost A. Anti-hypertensive Effects of Artichoke Supplementation in Adults: A Systematic Review and Dose-response Meta-analysis of Randomized Controlled Trials. Clin Nutr Res. 2022 Jul 26;11(3):214-227. doi: 10.7762/cnr.2022.11.3.214. PMID: 35949557; PMCID: PMC9348915.
20	CHICORY	Severe Heartburn, Stomach pain, Diarrhea, Nausea, Food Intolerance etc.	Faraji S, Hosseini Azar MRM, Alizadeh M. Brewed chicory leaf consumption has unexpected side effects along beneficial effects on liver enzymes in non-alcoholic fatty liver disease patients. Journal of Herbal Medicine. 2022;34:100572. doi: https://doi.org/10.1016/j.hermed.2022.10057

SI NO.	PLANT NAME	SIDE EFFECT	REFERENCE/CITATIONS
			2. Available from: https://www.sciencedirect.com/science/article/pii/S2210803322000410
21	ALOE VERA	Diarrhea, Abdominal pain, Vomiting, Hypokalemia.	Guo X, Mei N. Aloe vera: A review of toxicity and adverse clinical effects. J Environ Sci Health C Environ Carcinog Ecotoxicol Rev. 2016 Apr 2;34(2):77-96. doi: 10.1080/10590501.2016.1166826. PMID: 26986231; PMCID: PMC6349368.
22	FUMITORY	Lowered blood pressure, Nausea, and Vomiting.	http://www.prcupcc.org/herbs/herbsf/fumitory.htm
23	YELLOW DOCK	Nausea, Excessive urination, Diarrhoea Skin irritation,an Increased risk of blood clots etc.	Latif A, Fichadiya H, Abid F, Capo G. Herbal Teas and Thrombocytopenia: A Curious Case of Yellow Dock and Burdock-Induced Thrombocytopenia. Eur J Case Rep Intern Med. 2022 Mar 25;9(3):003247. doi: 10.12890/2022_003247. PMID: 35402325; PMCID: PMC8988498.
24	RHUBARB	Diarrhea, constipation and melanosis. Rhubarb might also damage liver under certain conditions.	Cao YJ, Pu ZJ, Tang YP, Shen J, Chen YY, Kang A, Zhou GS, Duan JA. Advances in bio-active constituents, pharmacology and clinical applications of rhubarb. Chinese Medicine. 2017;12(1):36. doi:10.1186/s13020-017-0158-5
25	REISHI	Might cause Nausea and	Jin X, Ruiz Beguerie J, Sze DM, Chan GC. Ganoderma lucidum (Reishi mushroom) for

SI NO.	PLANT NAME	SIDE EFFECT	REFERENCE/CITATIONS
	MUSHROOM	Insomnia.	cancer treatment. Cochrane Database Syst Rev. 2012 Jun 13;(6):CD007731. doi: 10.1002/14651858.CD007731.pub2. Update in: Cochrane Database Syst Rev. 2016;4:CD007731. PMID: 22696372.
26	ASTRAGALUS MEMBRANANCEUS	Excessive doses might cause immune suppression, Ingestion of large amount might cause selenosis etc.	St. John TM, Rakel D. Chapter 21 - Chronic Hepatitis. In: Rakel D, ed. Integrative Medicine. 4th ed. Elsevier; 2018:198-210.e5. doi:10.1016/B978-0-323-35868-2.00021-9. Available from: https://www.sciencedirect.com/science/article/pii/B9780323358682000219
27	GREEN TEA	Gastrointestinal disturbance and liver hepatotoxicity, cardiovascular probltems, Disrupts renal function, Hypokalemia, dizziness, insomnia etc.	Khaleel AK, Shaari RB, Nawi MAA, Al-yassiri AMH. Adverse Effects of Green Tea on Public Health the Untold whole Medical Story. SRP. (2020), [cited March 31, 2021]; 11(9): 883-887. doi:10.31838/srp.2020.9.128
28	GINKGO BILOBA	Might cause Stomach upset, Headache, Dizziness, Constipation, Forceful Heartbeat, and Allergic Skin Reactions.	Roland PD, Nergård CS. Ginkgo biloba--effekt, bivirkninger og interaksjoner [Ginkgo biloba--effect, adverse events and drug interaction]. Tidsskr Nor Laegeforen. 2012 Apr 30;132(8):956-9. Norwegian. doi: 10.4045/tidsskr.11.0780. PMID: 22562327.
29	CHINESE SKULLCAP	Oral administration of *Scutellaria baicalensis* might cause diarrhea, stomach pain, and other related symptoms.	Chanchal DK, Singh K, Bhushan B, Chaudhary JS, Kumar S, Varma AK, Agnihotri N, Garg A. An updated review of Chinese skullcap (Scutellaria baicalensis):

SI NO.	PLANT NAME	SIDE EFFECT	REFERENCE/CITATIONS
			Emphasis on phytochemical constituents and pharmacological attributes. Pharmacological Research - Modern Chinese Medicine. 2023;9:100326. https://doi.org/10.1016/j.prmcm.2023.100326.
30	BLACK SEED	Might cause Abdominal discomfort, Bloating, Dysgeusia, Diarrhea and Headache.	LiverTox: Clinical and Research Information on Drug-Induced Liver Injury [Internet]. Bethesda (MD): National Institute of Diabetes and Digestive and Kidney Diseases; 2012-. Black Cumin Seed. [Updated 2023 Apr 27]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK591552/

CONCLUSION

In conclusion, the liver stands as a vital organ in maintaining overall health, going through key functions ranging from detoxification to metabolism and immunological defense. However, multiple factors such as excessive alcohol use, infections, fatty liver disease and some drugs pose serious risk to liver health. To prevent the liver from harm and enable its regeneration hepatoprotective actions are needed.

Natural treatments provide interesting pathways for hepatoprotection utilizing the power of phytochemicals obtained from plants. These treatments such as silymarin, curcumin, resveratrol , epigallocatechin gallate etc. shows significant antioxidant, anti-inflammatory and regenerative characteristics important for safeguarding the liver from harm and helping its recovery.

The need for natural cures is shown by the worldwide incidence of liver illnesses, which continue to challenge traditional treatments owing to their limits and side effects. Natural treatments not only have hepatoprotective effects but also carry more therapeutic advantages greater than those of traditional drugs.

However although the potential of natural treatments in liver health appears certain more scientific study is needed to explain their methods of action , appropriate dose, and long-term safety. Detailed clinical research are necessary to evaluate their effectiveness and apply them successfully into mainstream healthcare practices therefore delivering comprehensive remedies for liver illnesses and improving public health efforts globally.

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2. Liver: Anatomy and Functions. Johns Hopkins Medicine. 2019. Available from: https://www.hopkinsmedicine.org/health/conditions-and-diseases/liver-anatomy-and-functions

3. The Liver and Its Functions. Available from: https://columbiasurgery.org/liver/liver-and-its-functions

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Gastroenterol. 2014 Oct 28;20(40):14787-804. doi: 10.3748/wjg.v20.i40.14787. PMID: 25356040; PMCID: PMC4209543.

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