

## AYURVEDIC MEDICATIONS FOR LIVER HEALTH

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**Abstract:-**

*The liver is a crucial organ that is important for the body's metabolism and xenobiotic excretion. The important health issue of liver damage and malfunction confronts not only medical professionals but also the pharmaceutical business and drug regulatory organizations. A variety of hazardous compounds, such as certain antibiotics, chemotherapeutic drugs, carbon tetrachloride (CCl<sub>4</sub>), thioacetamide (TAA), etc., can cause liver cell damage. Microbes and heavy alcohol consumption both induce liver damage. The synthetic medications used to treat liver diseases in this situation also induce more liver damage. Thus, the usage of herbal drugs has extended widely and gained popularity. For a very long time, liver problems have been treated with herbal medications. In the market, there are numerous herbal remedies including Liv-52 and Punarnavashtakkwath.*

**1.Introduction**

Is life worthwhile? The liver, the largest glandular organ, is a determining factor. Yakrit (liver) is regarded as a significant anga (organ) of the human body in Ayurvedic literature since the Vedic era. The liver's primary job is to maintain the body's overall health. It serves as a major hub for many processes, including the metabolism of nutrients like fats, proteins, and carbs. In order for different foreign and endogenous substances to be conveniently expelled via waste, it also aids in their metabolism. Periodic removal of these excretions from the body is required. The liver also acts as a hub for the secretion of numerous enzymes required for various types of reactions required for bodily homeostasis. As a result, the liver is a vital organ in the preservation of the body's physiological balance<sup>[4]</sup>. Therefore, any damage to it or impairment of its function has serious consequences for the affected person's health. Although viral infection is one of the main causes of hepatic damage, it is believed that 18,000 individuals die each year as a result of liver cirrhosis brought on by hepatitis. For proteins, glycogen, certain vitamins, and metals, it serves as a storage facility. By moving blood from the portal to the systemic circulation and its reticuloendothelial system, it also plays a part in the immune system and regulates blood volume. The smooth endoplasmic reticulum in the liver is the primary "metabolic clearing house" for both endogenous chemicals (such as cholesterol, steroid hormones, fatty acids, and proteins) and exogenous substances, despite the fact that almost all bodily tissues have some capacity to metabolize chemicals (e.g., drugs). Because of the crucial function the liver plays in the clearance and removal of medications, drugs have the potential to harm the liver and cause injury<sup>[4][1]</sup>. The major cause of liver failure is drug-induced liver damage (DILI), which is also a significant safety

concern when new medications are introduced. Most of the time, the true incidence of DILI is unknown. The three types of medications that harm the liver most frequently are antibiotics, analgesics, and NSAIDs. Drug-induced liver injury is currently the most frequent cause of acute liver failure in the US and several European nations (DILI). This is one of the main reasons why drug development fails and products are taken off the market. A major global health issue in addition to DILI is alcohol addiction and alcoholic liver disease (ALD), which claimed more than 3 million lives in 2012. According to a research released by the National Institute on Alcohol Abuse and Alcoholism, liver cirrhosis was the 12th largest cause of mortality in the United States in 2015, with 49.5% of those deaths being assessed to be attributable to ALD (NIAAA). Beginning with alcoholic steatosis, the pathophysiology of ALD progresses to alcoholic hepatitis (AH), liver fibrosis, cirrhosis, and ultimately hepatocellular cancer. Unfortunately, there are no effective treatments for ALD. Long non-coding RNA (lncRNA) and its function in HCC, drug-induced liver injury and steatosis, steatotic ischemia-reperfusion injury, and ALD, as well as possible serum biomarkers. Drug-metabolizing enzymes are concentrated in the liver, a key organ that is essential for the metabolism, excretion, and detoxification of xenobiotics like alcohol. Cytochrome P450 (CYP) oxidases, phase II processes (conjugation enzymes), and phase III excretion are the key components of these metabolic enzymes (transporters). Medications and xenobiotics added to the reactive and polar groups cause the lipophilic drugs to be transformed into hydrophilic products, which are more easily excreted. Despite the fact that some metabolic intermediates have also had toxic effects, these reactions aid in the body's detoxification of the drugs and xenobiotics <sup>[17]</sup>.

## **2. Hepatoprotective herbal plants**

### **2.1 *Tinosporacordifolia* (Guduchi) :-**

Kingdom – plantae

Clade – Tracheophytes

Clade – Angiosperms

Clade – Eudicots

Order – Ranunculales

Family – Menispermaceae

Genus- *Tinospora*

Species – *T. Cordifolia*

Common names – Gurjo, Heart Leaved Moonseed, Gulvel, guduchi or giloy <sup>[4]</sup>.

*Tinosporacordifolia*, often known as "Guduchi" or "Giloy," is one of the most priceless Ayurvedic plants for medical purposes. It is well known for its hepatoprotective, adaptogenic, immunomodulatory, and anti-fibrotic properties in contemporary medicine. Tinosporin, which corrects immunosuppression linked to hepatic function, is the active ingredient. Most liver damage is determined by Kupffer cells. Using the carbon clearance test as a parameter, the impact of *Tinosporacordifolia* (Wild.)Miers. on Kupffer cell function was assessed. *Tinosporacordifolia* (Wild.)Miers. was tested for antihepatotoxic activity in albino rats given carbon tetrachloride intoxication (CCl<sub>4</sub>)<sup>[2]</sup>. Liver function was evaluated using morphological, biochemical, and functional (Pentobarbitone sleep time) tests, including serum glutamate pyruvate transaminase (SGPT), serum glutamic-oxaloacetic transaminase (SGOT), serum alkaline phosphatase, and serum bilirubin. According to this test, it dramatically reduced the rat fibrosis that was caused by CCl<sub>4</sub>. Since ancient times, giloy or guduchi has been employed in Ayurveda. A typical herbal supplement found in the Indian complementary medicine practice of Ayurveda is *tinctoria cordifolia* (Giloy). To strengthen the immune system and avoid the corona virus sickness in 2019, this herb has been employed. The government of AYUSH suggested using *T. cordifolia* as a home treatment for immune support during the 2020–22 covid-19 outbreak in India. Consequently, due to its variety of benefits, it is frequently incorporated into the creation of other herbal hepatoprotective compositions like *Punarnavashtakkwath* (*punarnavasava*)<sup>[5]</sup>.

## 2.2 *Boerhaviadiffusa* Linn:-

Kingdom – Plantae

Clade- tracheophytes

Clade –Angiosperms

Clade – Eudicots

Order- Caryophyllales

Family – Nyctaginaceae

Genus- *Boerhavia*

Species-*B.diffusa*

Common name –*punarnava*, *Ictit*, *Kathilla* <sup>[6]</sup>.

*Boerhaviadiffusa* is a well-known Ayurvedic herb that is also popular in several regions of South America and Africa. In the aforementioned regions of the world as well as all of India, root is utilized as a medication for gastrointestinal, hepatoprotective, and

gynecological purposes. Due to its ability to regenerate during the wet season, it was used in ancient times. It can also be used as a vegetable in some parts of India. Punarnava has hepatoprotective properties because it stimulates bile secretion, which keeps the liver healthy and enhances liver function. Many tribes in India use the roots to treat internal inflammation and liver disorders. Additionally, it demonstrated efficacy in oedema and ascites that led to early liver cirrhosis. In ayurvedic texts, more than 35 formulations of different types contain it as major ingredient. It is one of the constituent of punarnavashtakkwath <sup>[1]</sup>.

Numerous bioactive substances have been found in *B. diffusa* plants, including tannins, flavonoids, alkaloids (punarnavine), glycosides, steroids, terpenoids, phenolic compounds, rotenoids (boeravinones A–O), and more. In albino rats, the impact of an ethanolic extract of *Boerhaviadiffusa* Linn. roots on locally brewed booze-induced hepatotoxicity was investigated. By lowering the levels of blood alanine amino transferase (ALT), triglycerides, cholesterol, and total lipids in both serum and tissues, the plant shielded the rats against hepatotoxic effects. Punarnava includes alkaloids called punarnavine and punarnavoside that have anti-fibrinolytic properties, but ursolic acid is thought to be responsible for the hepatoprotective properties. Ursolic acid from the leaves exhibits a dose-dependent (5–20 mg/kg) hepatoprotective action (21–100%) in rats against thioacetamide, galactosamine, and carbon tetrachloride caused hepatotoxicity in rats, as observed by Keppler and coworkers. By using the tests for trypan blue exclusion and rate of oxygen uptake, these hepatotoxins reduced the viability of hepatocytes. They also reduced the amount and concentration of bile. Rat hepatocyte viability dramatically increased after pretreatment with ursolic acid <sup>[2]</sup>.

Muthu lingam looked into the role of *B. diffusa* in treating hepatotoxicity brought on by the antituberculosis drug rifampicin in male albino Wistar rats <sup>[7]</sup>.

### **2.3 Punarnavashtakkwath (PNK) :-**

Punarnavashtakkwath (PNK) is a traditional Ayurvedic remedy for hepatic diseases and asthma that is referenced in the Ayurvedic book *Bhaishajya Ratnavali*. This study looked into the hepatoprotective properties of PNK to support its long-standing usage. PNK was made in a lab following the directions in the Ayurvedic texts. To find out whether phytoconstituents were present, phytochemical screening was done. Rats that were subjected to CCl<sub>4</sub>-induced hepatotoxicity had their hepatoprotective activity assessed, as well as the impact on the HepG2 cell line. Punarnavashtakkwath (PNK) is an Ayurvedic polyherbal remedy for asthma and hepatic problems that is referenced in the Ayurvedic

text BhaishajyaRatnavali. Its members include Boerhaaviadiffusa Linn. (Nyctaginaceae), PicrorhizakurroaRoyle ex Benth. (Scrophulariaceae), Tinosporacordifolia (Wild.)Miers (Menispermaceae), ZingiberofficinalisRosc. (Zingiberaceae), Berberisaristata DC (BerberidaceaeCurcubitaceae) plants. An aqueous extract of B. diffusa's thinner roots showed in vivo hepatoprotective efficacy against rat liver injury. P. kurroa and its active ingredients were successful in preventing liver damage brought on by a variety of toxic agents. Significant in vivo hepatoprotective activity and in vitro inactivating properties against Hepatitis B and E surface antigen were demonstrated by T. cordifolia in goats with CCl<sub>4</sub>-induced hepatopathy. Due to its direct potential for radical scavenging, the aqueous ethanol extract of Z. officinalis demonstrated hepatoprotective activity against acetaminophen-induced acute toxicity. Both paracetamol and CCl<sub>4</sub>-induced liver damage was reported to be prevented by B. aristata and berberine, an alkaloid from B. aristata. The aqueous extract of A. indica was discovered to provide protection against paracetamol-induced liver necrosis in rats, whereas T. chebula extract was found to stop the hepatotoxicity brought on by the injection of rifampicin, isoniazid, and pyrazinamide. Literature has shown that scientific evidence is available for the individual plants but not for this formulation, so in this investigation, PNK has been evaluated for its hepatoprotective action against CCl<sub>4</sub>-induced hepatotoxicity and its effect on HepG2 cell lines. T. dioica has been reported as a hepatoprotective agent in ferrous sulphate (FeSO<sub>4</sub>)-intoxicated rats. The hepatotoxin employed was CCl<sub>4</sub>, which mimics liver cirrhosis in humans by inducing liver dysfunction in rats. Silymarin is one of the plant-derived medications that has been licensed for use in treating cirrhosis and alcoholic liver illnesses. Numerous studies demonstrate silymarin's effectiveness in treating certain illnesses. As a result, silymarin was utilized in this study as a positive control to evaluate PNK's effectiveness in preventing CCl<sub>4</sub>-induced hepatotoxicity<sup>[8]</sup>.

PNK contains alkaloids, tannins, flavonoids, saponins, and a bitter ingredient, according to preliminary phytochemical screening. Aspartate transaminase, serum alanine transaminase, serum alkaline phosphatase, and serum bilirubin levels were significantly lowered and protein levels increased after PNK administration, demonstrating a considerable hepatoprotective impact. In comparison to the mice treated with CCl<sub>4</sub>, thiopentone-induced sleep period was also shorter in the PNK-treated animals. Additionally, it demonstrated antioxidant activity through an increase in glutathione, superoxide dismutase, and catalase activity as well as a decrease in the level of thiobarbituric acid reactive substance when compared to the group that had received CCl<sub>4</sub>. An investigation using the HepG2 cell line showed that cells exposed to PNK had significantly higher viability than cells treated with CCl<sub>4</sub><sup>[9]</sup>.

**2.4 Piper Nigrum :-**

Kingdom: Plantae

Class: Equisetopsida

Sub class: Magnoliidae

Super order: Magnolianaes

Order: Piperales

Family: Piperaceae

Genus: Piper

Species: nigrum

It is a popular spice among many others. It is known as the "king of spices" and has therapeutic qualities. Piper nigrum is also known as peppercorn, white pepper, green pepper, black pepper, Madagascar pepper in English and is known as Kali Mirch in Urdu and Hindi, Pippali in Sanskrit, Milagu in Tamil, and Pippali in Sanskrit. It includes the potent piperine alkaloid (1-peperoyl piperidine). Piperine exhibits a variety of pharmacological effects, including antihypertensive, antiplatelet, antioxidant, antitumor, antiasthmatic, antipyretic, analgesic, anti-inflammatory, anti-diarrheal, antispasmodic, anxiolytic, antidepressants, hepatoprotective, immuno-modulatory, antibacterial, antifungal, anti-thyroid, antiapoptotic, anti-metastatic

Hepatoprotective activity of black pepper:

Piperine was found to inhibit the rise in serum glutamic pyruvic transaminase (GPT) and serum glutamic oxaloacetic transaminase (GOT) levels brought on by a mouse model of hepatotoxicity brought on by D-galactosamine in dose-dependent studies.

When Wistar rats were exposed to ethanol-CCl<sub>4</sub> to cause liver injury, the hepatoprotective efficacy of Piper nigrum fruit methanolic extract was assessed. The rats were given ethanol-CCl<sub>4</sub> to cause hepatotoxicity. Pre-treatment with piperine at a dose of 50 mg/kg body weight, p.o. for 15 days prior to the ethanol-CCl<sub>4</sub> treatment showed significant liver protection as evidenced by the levels of triglycerides, Alanine transaminase, Aspartate transaminase, alkaline phosphatase, bilirubin and superoxide dismutase, Catalase, Glutathione reductase, and Lipid. In this study, triglycerides, Alanine transaminase, Aspartate transaminase, alkaline phosphatase, and bilirubin levels were significantly increased after ethanol-CCl<sub>4</sub> administration, whereas superoxide

dismutase, catalase, and glutathione reductase levels were significantly decreased but returned to normal after pre-treatment with methanolic extract of *Piper nigrum* and piperine. Following pretreatment with *Piper nigrum* and piperine methanolic extract at the recommended levels, lipid peroxidation were also dramatically reduced. The outcomes matched those of reference standard-Liv52 when given orally for 15 days at a dose of 1 mL/kg. The liver's morphological and histological analyses confirmed the biochemical data. As a result, it is determined that *Piper nigrum* has significant therapeutic potential in the treatment of liver diseases and may have potential hepato-protective effect due to the presence of piperine alkaloids<sup>[10][11]</sup>.

## 2.5 Katuki:-

Scientific Name: *Picrorhizakurroa*

Kingdom: Plant

Order: Lamiales

Family: Plantaginaceae

Genus: *Picrorhiza*

Species: *kurroa*

### Synonyms

- i. PradhanaNama (Main Name): Katuka, Tikta, Katurohini
- ii. Upama (Representation): Matsyashakla
- iii. Svarupa (Morphology): Chakrangi, Krishna bheda, Shat parva
- iv. Due to regeneration from stem: Kaandrooha
- v. Karma (Action): Amghani, Arishta

### Important Formulations of Katukiherb:

- i. Arogyavardhinigutika
- ii. Tiktakaghrita
- iii. Mahatiktakaghrita
- iv. Sarvajvaraharalauha
- v. Katukadyaghrita

A well-known herb for its hepatoprotective effects is katuki or *Picrorhiza*. Katuki is well known for assisting in the removal of our bodies' excess fire energy and serving as a

cooling agent. It keeps the pitta and kapha, which can lead to acidity, digestive issues, etc., in balance. As a result, it aids in better digestion and protein, carbohydrate, and fat metabolism. This medication has been used medicinally for at least 5000 years. Anti-Asthmatic, anti-cancer, anti-inflammatory, anti-microbial, antidiabetic, immunomodulator, antioxidant, and other pharmacological properties are just a few of the pharmacological effects of katuki plant.

#### Hepatoprotective Activity:

Widely utilized and well-known as a hepatoprotective agent is katuki. Kupffer cells, which are the main cause of issues in the regeneration process in liver injuries, are where this plant's extract comes into play by acting as a cell suppressant. This plant's rhizome and roots contain the Picrolivairidoidglucoside molecule, which is a combination of Picoside-1 and Kutkoside (1.0:1.5, w/w). Picroliv's hepatoprotective properties were investigated in the liver of rats after ethanol-induced liver damage. This plant is currently utilized to treat a number of liver conditions, such as cirrhosis, radiation toxicity, viral hepatitis, fatty liver, and ischemia injury. Studies have shown that picroliv protects the liver from the effects of alcohol, carbon tetrachloride, paracetamol, and aflatoxin <sup>[12]</sup>.

## 2.6 Phyllanthusniruri Linn:-

Kingdome –Plantae

Clade-Tracheophytes

Clade:-Angiosperms

Clade:-Eudicots

Clade:-Rosides

Order:-Malpighales

Famlily -:-Phyllanthaceae

Genus:-Phyllanthus

Species:-P.Niruri <sup>[13]</sup>.

Since more than 2000 years ago, PhyllantusNiruri Linn has been used as a medicine to treat secondary hepatitis and in numerous ayurvedic formulations. It is one of the oldest plants used to treat liver disorders and internal healing. This plant's phytochemicals have shown promise in treating hepatic diseases. Recently, scientists discovered its efficacy in liver cancer and demonstrated its efficacy in cancers related to the liver. Quercetin-3-O-rhamnosie and 4-O-caffylquinic acid were isolated from the ethanolic extract and were primarily responsible for the hepatoprotective effect. This extract was administered to male Sprague-Dawley rats that had been given thioactamide to induce cirrhosis, and it

was successful in preventing high extracellular matrix synthesis as well as reduced expressions of transforming growth factor-, collagen a1, and metalloproteinase. In rats, phyllanthin and hypophyllanthin provided protection against CCl4-induced liver damage. These two substances significantly decreased the liver injury indicators glutamate oxaloacetate transaminase and glutamate pyruvate transaminase, which are produced by CCl4. Protocatechuic acid, niruriflavone, and pectolinarin, among other phytochemicals from this plant, also demonstrated hepatoprotective effects. Scientists have established that it is effective against hepatitis B viruses. Out of 37 people, 22 have completely recovered from hepatitis B and exhibit no surface antigen of the disease. Additionally, it displays the DNA polymerase on the hepatitis B virus, which is in charge of viral replication. This inhibition causes the drug to have a protective effect against liver cancer<sup>[2]</sup>.

It is additionally utilized in numerous herbal tablet preparations for liver damage. Its extract effectively treats liver damage.

## 2.7 BerberisAristata:-

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnoliopsida

Order: Ranunculales

Family: Berberidaceae

Species: aristata

Genus: Berberis

Vernacular Names

Sanskrit: Katamkateri, Dirvi

Bengali: Daruharidra English: Indian Berberry

Gujrati: Daruharidra, Daruhuladur Hindi: Daruhaldi, Darhald

Kannada: Maradarishana, Maradarishina, Daruhaladi

Malayalam: Maramannal, Maramanjal

Marathi: Daruhalad

Oriya: Daruharidra, Daruhalidi

Punjabi: Sumalu

Tamil: Gangeti, Varatiumanjai

Telugu: Manupasupu

Urdu: Darhald

Spinous herb *Berberisaristata*, also known as "Daruhaldhi and Chitra," is a native of the northern Himalayas. The plant can be found in the Himalayan regions that extend to Sri Lanka, Bhutan, and Nepal's hilly regions. The plant has historically been used to treat inflammation, wound healing, skin conditions, menorrhagia, diarrhea, jaundice, and eye ailments. Pharmacological research on the plant reveals its demonstrated anticancer, hepatoprotective, antibacterial, antifungal, antipyretic, antipyretic, and hypoglycemic properties. This plant produces the highly valuable ayurvedic remedy "Rashut," which is used to treat human illnesses like ophthalmic and ulcers as a laxative, tonic, and blood purifier. The primary alkaloids found in *berberisaristata* are yellow-colored. Berberine, oxyberberine, berbamine, aromoline, kara chine, a protoberberine alkaloid, palmatine, oxyacanthine, taxilamine, tannins, sugar, and starch are all components. Ayurveda has employed the roots of *B. aristata* to treat jaundice. The dried aerial component of *B. aristata* was tested for hepatoprotective and antioxidant efficacy against CCl<sub>4</sub>-induced liver injury in aqueous and methanolic extract with berberine. The outcomes were comparable to those of the common medication silymarine. The hepatoprotective action of the crude extract of *B. aristata* (Shoot and fruit) is partially mediated through inhibition of microsomal drug metabolizing enzyme, as shown by the protection against induced liver toxicity demonstrated by paracetamol and CCl<sub>4</sub> in the extract. Effective hepatoprotective action of *Berberisaristata* butanoic extract is demonstrated by specific inotropic activity <sup>[14]</sup>.

## 2.8 *CapparisSpinosa* :-

Kingdom –Plantae

Clade-tracheophytes

Clade- Angiosperms

Clade – Eucots

Clade – Rosids

Order – Brassicales

Family – Capparaceae

Genus – *Capparis*

Species – *C. Spinosa*

Common Name –Himsara, Caper Bush, Fliners Rose, Etc. <sup>[15]</sup>.

Acute liver damage caused by tert-butyl hydroperoxide (t-BHP) is investigated in a recent study to determine the antioxidant and hepatoprotective effects of *Capparis spinosa* L. and

quercetin. Antioxidant properties and the total phenolic content of several *C. spinosa* fractions were investigated. Among these fractions, hydroalcoholic extract was used to evaluate the hepatoprotective effect in tert-butyl hydroperoxide (t-BHP) induced hepatotoxicity model by monitoring serum biochemical markers, sleep patterns, antioxidant assays like reduced glutathione (GSH), as well as histopathological analysis of liver tissues. It was proven by a pathology test-confirmed significant increase in glutathione (GSH), superoxide dismutase (SOD), and catalase (CAT) activity and a significant decrease in blood enzyme markers, sleep duration, and MDA. The final findings established the dose-dependent hepatoprotective and antioxidant effects of *C. spinosa* and Quercetin. Most evidence suggests that the scavenging of free radicals, which may be a result of the presence of phenolic compounds, may be the possible mechanism of this protection<sup>[16]</sup>. It is a component of the well-known mixture Liv -52.

## 2.9 Licorice :-

Kingdom – Plantae

Clade-tracheophytes

Order –Fabales

Family-Fabaceae

Subfamily –Faboideae

Genus –Glycyrrhiza

Species –G.Glabra<sup>[17]</sup>.

The roots of licorice plants contain the triterpene glycoside glycyrrhizic acid (GA) (*Glycyrrhiza labra*). The most significant active component of licorice root, GA, has a variety of pharmacological and biological effects. In China or Japan, GA was combined with glycyrrhetic acid and 18-beta-glycyrrhetic acid to create a medication for liver disease that was anti-inflammatory, antiviral, and antiallergic. The main mechanism of action is the inhibition of hepatic apoptosis and necrosis. The hepatoprotective properties of GA are attributed to its inhibition of TNF- and caspase-3, which also has anti-inflammatory and antiapoptotic effects. The release of cytochrome C from mitochondria into the cytoplasm is also considerably inhibited by GA. GA's ability to reduce inflammation may be due to its ability to prevent the production of TNF-, myeloperoxidase activity, and nuclear factor-B (NF-B) from entering cells. Proliferating cell nuclear antigen expression was also elevated by GA, suggesting that it may be able to encourage the healing of liver damage. High-mobility group box 1 (HMGB1) production

and ischemia-reperfusion (I/R)-induced liver damage are both mediated by activated Kupffer cells. It was discovered that GA stopped Kupffer cells from producing HMGB1 and stopped liver damage brought on by I/R. Additionally, GA conjugates free radicals, which could account for GA's protective effects. One of the most frequently found substances in natural treatments is licorice. It has been a part of traditional medicine for a very long time <sup>[18]</sup>.

## **2.10 Cichoriumintybus Linn:-**

Kingdom: Plantae

Clade: Tracheophytes

Clade: Angiosperms

Clade: Eudicots

Clade: Asterids

Order: Asterales

Family: Asteraceae

Genus: Cichorium

Species: C. intybus

Chicory, or *Cichoriumintybus* Linn, is a member of the Asteraceae family. It is utilized as a diuretic, cardiogenic, anti-inflammatory, digestive, stomachic, and liver tonic in Indian System of Medicine. All parts of the plant contain the phytoconstituents, which include the sesquiterpene lactones cichoriolide A, B, and C, lactucin, 8-deoxylactucin, and lactopicrin. According to reports, inulin, reducing sugars, and sucrose are the primary components of *Cichorium intybus* found in the root <sup>[19]</sup>. The ethnobotanical research have reported the use of leaves in treating jaundice, liver problems, vomiting, loose stools, fever, and pleurisy. These studies also reported the use of alpha-amyrin, taraxerone, baurenin acetate, and beta-sitosterol. Its numerous plant parts are helpful in treating illnesses of the liver. Spleen enlargement, liver enlargement, a bitter tonic that works for jaundice, etc. Scientists looked at isolated polysaccharides from chicory root that were primarily made of sorbin, glucose, fructose, and glucitol in high-fat diet-induced NAFLD (non-alcoholic fatty liver disease). Rat liver histopathology revealed that chicory polysaccharides may effectively treat non-alcoholic fatty liver disease by activating AMP-activated protein kinase. The anti-inflammatory and hepatoprotective properties of *Cichorium intybus* root extracts have been demonstrated in pharmacological research. Jigrine was tested as an oral pretreatment for hepatic damage brought on by paracetamol in rats. Increases in serum transaminase, bilirubin, plasma prothrombin time, and tissue

lipid peroxides were seen in the liver after treatment with alcohol, CCl<sub>4</sub>, and paracetamol. Jigrine pretreatment doses gradually lessened the severity of these side effects. Jigrine's effectiveness was also contrasted with that of Liv-52, an established Ayurvedic hepatoprotective compound. It was discovered that the methanolic fraction and a phenolic compound from the seed of *C. intybus* had anti-hepatotoxic properties that were as effective as silymarin. The results were supported by liver histopathology tests and biochemical indicators. The effects of the ethanol extract of *Cichorium intybus* on the immunotoxicity of ethanol (EtOH) in ICR mice The combination of CIEE and EtOH showed a significant increase in the number of circulating leukocytes and the relative weights of the liver, spleen, and thymus when compared to mice treated with EtOH alone. The findings demonstrated that the immunotoxicity brought on by EtOH is significantly restored or avoided by CIEE treatment [20].

#### In Vitro Hepatoprotective Activity of the Plant:

*Cichorium endivia* extract (CEE) was studied for its in vitro and in vivo hepatoprotective effects and its chemical components<sup>65</sup>. Tert-butyl hydroperoxide (t-BHP) caused oxidative stress and cytotoxicity in HepG2 cells, which were considerably reduced by CEE. Inhibiting the changes in liver biochemistry including MDA (malondialdehyde), SOD (superoxide dismutase), GSH (glutathione), and GST (glutathione transferase), as well as ameliorating the liver injuries according to the histopathological observations, oral administration of CEE to mice prior to the treatment of t-BHP exhibited a markedly protective effect. Investigated were the potential processes underlying *Cichorium intybus* L.'s acute liver damage hepatoprotective efficacy. The liver protective effect of *Cichorium intybus* L. was demonstrated through pathological observation, reactive oxygen species detection, and measures of biochemical indicators in mice models.

#### 2.11 MandurBhasma :-

Red iron oxide, or ferric oxide, makes up MandurBhasma (Fe<sub>2</sub>O<sub>3</sub>). The method used to create the medication, however, makes sure that the ferric oxide is processed with herbs and heated to a high temperature during calcination, which lessens the negative effects of iron on the body and actively increases its bioavailability. Jaundice and various types of anemia are treated with MandurBhasma.

In CCl<sub>4</sub>-induced liver damage, Mandur Bhasma's hepatoprotective activity has been studied. Its hematinic and lipolytic characteristics have also been found. This traditional iron formulation, which possesses strong hepatoprotective and hepatostimulative qualities, offers a miraculous treatment during jaundice, in which the liver is mostly damaged. Mandurbhasma not only lowers blood bilirubin levels, but it also improves liver function by detoxifying and cleaning the liver. Mandurbhasma is also recognized for

treating hemolytic jaundice and hepatitis. By causing lipolysis, its lipolytic properties are also helpful in treating fatty liver disease. Mandurbhasma induces and acts as a lipolytic. By lowering cellular insulin resistance, lipolysis, or the breakdown of fats, may control the blood's insulin level. A high insulin level may block lipolysis, which causes fat to accumulate in the liver and other body tissues (particularly visceral organs). Steatosis results from the liver storing fat when there is hyperinsulinemia. Mandurbhasma has two effects. It affects cellular insulin resistance and lowers blood insulin levels by promoting adequate insulin uptake by cells and signaling an excess of insulin in the blood, which in turn controls insulin secretion. Second, Mandurbhasma treats fatty liver disease by increasing fat metabolism in the body and burning accumulated fat <sup>[21]</sup>.

### **2.12 Liv 52 :-**

A multi-herbal hepatoprotective medication is Liv-52. It has been previously researched how Liv-52 affects ethanol-induced liver damage. According to the findings, Liv-52 therapy inhibits the ethanol-induced rise in  $\gamma$ -glutamyl transpeptidase activity. Capparis spinosa (Himsara), Cichorium intybus (Kasani), Mandurbhasma, Solanum nigrum (Kakamachi), Terminalia arjuna (Arjuna), Cassia occidentalis (Kasamarda), Achillea millefolium (Biranjasipha), and Tamari gallica are the seven herbs that make up Liv-52 (jhavaka). In addition, there was a concurrent drop in ethanol levels, which highlighted the extent of lipid peroxidation in the liver after Liv-52 treatment. Following ethanol consumption, glutathione levels and the activity of antioxidant enzymes such as superoxide dismutase, glutathione peroxidase, and others reduced. Treatment with Liv-52 was found to have protective effects on glutathione levels and superoxide dismutase activity. Results point to Liv-52's hepatoprotective properties, which may be explained by its capacity to reduce lipid peroxidation <sup>[20]</sup>.

### **2.13 Solanum nigrum:-**

Kingdom: Plantae

Clade: Tracheophytes

Clade: Angiosperms

Clade: Eudicots

Clade: Asterids

Order: Solanales

Family: Solanaceae

Genus: Solanum

Species: *S. nigrum*

The flowering plant species *Solanumnigrum*, often known as the European black nightshade, black nightshade, or blackberry nightshade, belongs to the genus *Solanum*. The short-lived perennial plant known as black nightshade is a widespread herb that can also be found in disturbed habitats and many woodland regions. Another variety with berries that turn crimson when mature is discovered in India. Black nightshade has been widely used in traditional medicine in India and other parts of the world to treat peptic ulcers, inflammatory problems, painful periods, fevers, diarrhea, eye infections, and chronic skin conditions (including psoriasis and ringworm). *S. nigrum* water extract has been tested for its ability to protect rats' livers from CCl<sub>4</sub>-induced chronic hepatotoxicity. *S. nigrum* was shown to modify the antioxidant defense pathway, thereby reducing CCl<sub>4</sub>-induced lipid peroxidation. However, the histopathological changes brought on by the oral administration of the toxin were reversed by the administration of the plant extracts and the hepatotoxin in a dose-dependent manner. The standardized flavonoid extract of *S. nigrum* has been found to have strong hepatoprotective properties, according to the current investigation. The most prevalent polyphenolic phytochemical with significant therapeutic effects is thought to be flavonoids. Numerous earlier studies have documented *S. nigrum*'s ability to protect the liver from acute toxicity caused by CCl<sub>4</sub>. By enhancing the DNA, RNA, and protein levels as well as the energy levels of the hepatic tissue, *S. nigrum* was found to confer significant dose-dependent hepatoprotection against CCl<sub>4</sub>-induced sub-chronic toxicity in the current study <sup>[22]</sup>.

### **Conclusion –**

The fact that these medications would need to be digested in the liver poses the biggest threat to the contemporary medical system when it comes to liver problems. Due to the advantage of being a fully natural science, Ayurveda has grown immensely popular in recent years. The fact that the herbs and plants used in Ayurveda do not have side effects that resemble those of allopathic medication is one of its advantages over allopathy. The use of ayurvedic medicine can stop additional liver tissue scarring, address the underlying causes of the condition, and even promote liver cell regeneration. These aid in clearing the body of toxins that have built up. Consequently, the liver and the entire digestive system operate normally. All additional complications slowly go away as the liver functions improve. The hepatoprotective and immunomodulatory properties of some herbal medicines have been studied in this article. As a result, medications like liv 52,

tinospora cordifolia, piper nigrum, etc. help to maintain the health of the liver, which in turn helps to maintain the balance of all bodily functions. Maintaining liver health translates to living longer, healthier years.

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