A Review on Hepatoprotective Herbal Plants

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ABSTRACT
The liver is an important organ that aids in xenobiotic metabolism and elimination. Excessive alcohol use, toxic substances (particular chemotherapeutic drugs, antibiotics, thioacetamide (TAA), carbon tetrachloride (CCl₄), and microorganisms) have all been shown to induce liver cell harm. In this scenario, the current synthetic medications to treat liver problems exacerbate liver damage. As a result, herbal medicines have grown in popularity and are widely used. Herbal remedies have long been used to treat liver problems, and maintaining a healthy liver is critical for an individual's overall health. On the market, there are a variety of herbal preparations. The goal of this study is to collect information on potential phytochemicals from medicinal plants that have been investigated in hepatotoxicity models using contemporary scientific methods.

Keywords: Medicinal plant, Liver, Hepatoprotective, Phytochemical, Hepatotoxicity.

INTRODUCTION
Traditional medicines, contemporary medications, nutraceuticals, dietary supplements, folk medicines, pharmaceutical intermediates, bioactive principles, and lead compounds in synthetic pharmaceuticals all use medicinal plants as a source of innovative drugs. Plants provide primary health care for more than 80% of the world’s population, according to WHO. Overexploitation of chosen medical plant species, on the other hand, resulted in a decrease in the number of plants in the wild and their names being added to the red data book 1, 2. Nature has provided an abundance of therapeutic plants on our nation. Throughout history, plants have been employed as a traditional healing method. The WHO has identified 20,000 medicinal plants worldwide, with India accounting for 15-20% of them. 3 According to the WHO, medicinal plants are used in 80 percent of the world’s countries. 4 A substantial amount of data has been gathered to demonstrate the potential of medicinal herbs employed in diverse traditional systems. Over 13 000 plants have been examined for various diseases and afflictions all over the world in the last few years. 5, 6

Liver Diseases
The liver is the most vital organ in the body, as it is responsible for many physiological functions. It helps in metabolism, secretion, and storage, among other things. Many exogenous and endogenous chemicals are detoxified and excreted through it. As a result, any damage to it or impairment of its function has serious health consequences for the individual afflicted. Although viral infection is one of the leading causes of hepatic damage, over 18,000 people are known to die each year from liver cirrhosis induced by hepatitis. The liver’s critical function in chemical clearance and transformation makes it vulnerable to drug-induced harm. 7

Figure 1: Structure of Liver
Liver disorders are one of the most dangerous illnesses. Acute or chronic hepatitis (inflammatory liver disorders), hepatosis (non-inflammatory diseases), and cirrhosis are the different types (degenerative disorder resulting in fibrosis of the liver). Toxic substances (particular antibiotics, chemotherapeutics, peroxidized oil, aflatoxin, carbon-tetrachloride, chlorinated hydrocarbons, etc.), excessive alcohol use, infections, and autoimmune/disorders are the primary causes of liver disease 8.
Causes of Liver Diseases

Because of food choices, alcohol use, poor cleanliness, uncontrolled drug use, and smoking, liver problems are the most frequent health concern in underdeveloped nations. Non-inflammatory, inflammatory, and degenerative liver disorders are all possibilities. Hepatic insufficiency is linked to a higher risk of atherosclerosis and cardiovascular disease. Hepatotoxicity can be induced by a variety of poisons such as carbon tetrachloride (CCl₄), thioacetamide, acute or chronic alcohol intake, diseases such as hepatitis A, B, and C, and drugs, with drugs being the most prevalent culprit. Hepatitis and cirrhosis are caused by the production of free radicals caused by alcohol use.

Role of Medicinal Plants in Hepatotoxicity

Plant materials have been employed in Ayurveda to protect the liver from different poisons and dietary factors.

Table 1: List of Plant has Hepatoprotective Activity

| Plant Name                  | Plant part | Extract         | Active constituents                              | Mechanism                                                                 |
|-----------------------------|------------|-----------------|-------------------------------------------------|--------------------------------------------------------------------------|
| Allium sativum              | Bulb       | -               | Organosulfur compounds                          | Prevention of GSH depletion, alteration of GSH-dependent Enzymes          |
| Azadirachta indica          | Leaf       | 70% ethanol     | Flavonoids                                      | (Glutathione peroxidase (GPx), glutathione-S-transferase (GST), superoxide dismutase (SOD) and catalase (CAT)) |
| Arachniodes exilis          | Rhizomes   | Ethanol         | Polyphenols                                     | Lipid peroxide, DPPH, ABTS, superoxide anion, hydroxyl radical and hydrogen peroxide, glutamate oxaloacetate transaminase, glutamate pyruvate transaminase, malondialdehyde and superoxide dismutase |
| Asparagus racemosus         | Whole plant| purified aqueous fraction | Polysaccharides                               | Lipid peroxidation, protein oxidation                                    |
| Baliospermum montanum       | Roots      | Alcohol, chloroform | -                                               | SGPT, SGOT and alkaline phosphate, Histopathological changes in liver.    |
| Buddleja officinalis        | flowers and buds | - | Phenyl ethanoid Glycoside (Acteoside) | Decreased levels of AST, ALP                                           |
| Boerhaavia diffusa          | Roots      | Aqueous         | -                                               | GOT, GPT, ACP and ALP, but not GLDH and bilirubin                        |
| Cassia tora                 | Leaves     | Ethyl acetate   | -                                               | Glutathione enzyme activities.                                           |
| Camellia sinensis           | Leaves     | -               | Polyphenols (Catechin)                          | Inhibited hepatocellular apoptosis and unregulated Bcl-2 protein expression |
| Cistus laurifolius L.       | Leaves     | Ethanol         | Flavonoid (Quercetin)                           | MDA, AST, GSH levels decreased                                           |
| Corydalis saxicola          | Whole plant| Ethanol         | Alkaloid Dehydrocavidine                        | Decreased levels MDA, SOD, GPx                                           |
| Cordia macleodii            | Leaves     | Ethanolic       | Flavonoids and triterpenoids                    | Increased Glutamate pyruvate transaminase (GPT), serum glutamate oxaloacetate transaminase (GOT), Alkaline Phosphatase (ALP) and total bilirubin |
| Cassia fistula              | Leaf       | Methanol        | Anthraquinone and steroids                      | Lowering the serum levels of transaminases (SGOT and SGPT), bilirubin and alkaline phosphate (ALP). |
| Cochlospermum Planchoni     | Rhizomes   | Aqueous         | Tannins, carotenoids, flavonoids and triterpenes| Total bilirubin Alkaline phosphatase Alanine aminotransferase              |

As a result, herbal medications have gained popularity in recent years due to their safety and capacity to heal ailments. These drugs are also incredibly cost-effective when used for a long time. Many medicinal plants found across India have been identified as hepatoprotective medications, and they are widely utilised to treat liver problems. Hepatoprotective action is found in a variety of plants and polyherbal preparations. Hepatoprotective action has been claimed for around 160 phytoconstituents and other phytochemicals. Over 87 plants are utilised in India, with 33 of them being trademarked and having exclusive multi-ingredient plant compositions. The authors analysed studies on medicinal plants' hepatoprotective properties and grouped them in systematic order as indicated in table 1.
| Plant Name | Part Used | Solvent | Constituent | Biological Activity |
|------------|-----------|---------|-------------|---------------------|
| **Eglets viscosa** Less. (Asteraceae) | Whole plant | Hexane and Ethanol | Flavonoid (Ternatin) | Decreased lipid peroxidation |
| **Gardenia jasminoides** (Rubiaceae) | Fruit | - | Iridoid Glicoside Geniposide | Antioxidant |
| **Ginkgo biloba** L. (Ginkgoaceae) | Leaves | Petroleum ether | Polyphenols | ALT, AST, ALP, ALB, TP, HA, LN, TG, and CHO levels decreased |
| **Gossypium herbaceum** (Malvaceae) | Root, leaves, stem | - | Polyphenols Gossypol | Antioxidant |
| **Hibiscus sabdariffa** L. (Malvaceae) | Flowers | Ethanol, chloroform | Polyphenols Protocatechuic acid | LDH, AST, ALP, MDA levels decreased |
| **Gardenia jasminoides** (Rubiaceae) | Fruit | - | Iridoid Glicoside Geniposide | Antioxidant |
| **Ginkgo biloba** L. (Ginkgoaceae) | Leaves | Petroleum ether | Polyphenols | ALT, AST, ALP, ALB, TP, HA, LN, TG, and CHO levels decreased |
| **Gossypium herbaceum** (Malvaceae) | Root, leaves, stem | - | Polyphenols Gossypol | Antioxidant |
| **Hibiscus sabdariffa** L. (Malvaceae) | Flowers | Ethanol, chloroform | Polyphenols Protocatechuic acid | LDH, AST, ALP, MDA levels decreased |
| **Larrea tridentata** (Zygophyllaceae) | Leaves | Juice of the fresh leaves and ethanolic extract | - | Increased Serum glutaryl oxalacetic acid transaminase (SGOT), serum glutaryl pyruvate transaminase (SGPT) alkaline phosphatase (ALKP), serum bilirubin (SBLN) |
| **Magnolia officinalis** (Magnoliaceae) | Bark, root, stem | - | Polyphenols Magnolol | Antioxidant |
| **Momordica dioica** (Cucurbitaceae) | Leaves | Ethanol and aqueous | - | Decreased serum glutamate oxaloacetate transaminase (AST), serum glutamate pyruvate transaminase (ALT), serum alkaline phosphatase (SALP) and total bilirubin (SBLN) |
| **Magnifera indica** (Anacardiaceae) | - | - | Triterpene (Lupeol) | Decreased levels of SGOT, SGPT, ALP, and bilirubin |
| **Nigella sativa** (Ranunculaceae) | - | - | Quinones Thymoquinone (TQ) | Scavenger of superoxide, hydroxyl radical, and singlet molecular oxygen |
| **Ocimum basilicum** (Lamiaceae) | Leaves | Methanol | - | AST, ALT, SGOT levels decreased |
| **Orthosiphon stamineus** (Lamiaceae) | Leaves | Methanol | - | AST, ALT and ALP |
| **Peumus boldus** (Monimiaceae) | - | - | Alkaloid Boldine | Lipid peroxidation |
| **Pinus maritima** (Pinaceae) | Bark | - | Polyphenols (Pycnogenol) | SOD, GSH-Px, GSH-reductase, and TBARS levels decreased |
| **Rubia cordifolia** (Rubiaceae) | Roots | 50% aqueous ethanolic | Glycoside (Rubiaidin) | SGOT, SGPT, SALP, and gamma-GT levels decreased |
| **Schisandra chinensis** (Schisandraceae) | Bee pollen | - | Lignans (Wuweizisu) | Antioxidant |
| **Sida cordifolia** (Malvaceae) | Leaves | Aqueous | Organic compound (Fumaric acid) | Antioxidant |
| **Silybum marianum** (Asteraceae) | - | - | Lignans (Silymarin) | Antioxidant |
| **Tridax procumbens** (Asteraceae) | Leaves | Ethanol | - | Decreased Glutathione, superoxide dismutase and catalase |
| **Vitis vinifera** (Vitaceae) | Leaves | Chloroform, ethanol, and water | Phenolic compounds | Decreased plasma and liver tissue MDA, transaminase enzyme levels in plasma (AST-aspartate transaminase, ALT-alanine transaminase) and liver GSH (glutathione) levels |
| **Zanthoxylum armatum** (Rutaceae) | Bark | Ethanol | Isoquinoline alkaloid, berberine, as well as flavonoids and phenolic compounds | Decreased serum transaminases, alkaline phosphatase and total bilirubin and antioxidant enzymes: superoxide dismutase, catalase and glutathione |
CONCLUSION
Since ancient times, herbal and traditional botanical medicines have been utilised to cure a variety of ailments and diseases. Active extracts, fractions, or a combination of fractions/extracts might prove to be extremely effective medications. For liver disorders, plant medications (combinations or single pharmaceuticals) should be effective enough to treat serious liver diseases caused by toxic chemicals, viruses (Hepatitis B, Hepatitis C, etc.), excessive alcohol use, and other factors. All forms of severe liver disorders cannot be treated with a single medicine. Effective formulations must be created utilising indigenous medicinal herbs, as well as pharmacological tests and clinical studies. Standards of safety and efficacy should regulate the manufacturing of plant products. 

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