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Review on hepatoprotective activity of medicinal plants

Lithashabin PK[1*], Sajithkumar PN[2], Rajagopal PL[3], Arthi I[4], Anjana AK[5], Yamuna CV[6]
[1-5] College of Pharmaceutical Sciences, Government Medical College, Kannur, Kerala, India

Abstract
Liver has a pivot role in regulation of physiological process. it is involved in several vital functions such as metabolism, secretion and storage. And also detoxification of a variety of drugs and xenobiotics occurs in liver. liver diseases are mainly caused by toxic chemicals, excess consumption of alcohol, infections and autoimmune disorder. the synthetic drugs that are used for the treatment of liver disorder can also cause further damage to the liver. Herbal remedies are focused in the pharmaceutical industry to evolve safe route for liver disorders. there for hepatoprotective natural plants such as *Bambusa bambos, Melia azaderach, Cinnamomum zeylanicum, Zingiber officinale, Ocimum sanctum, Curcuma longa, Vitis vinifera, Ginko biloba, piper longum, Accacia catechu, Tylophora indica, Andrographis paniculata and swertia chirayita.*

Keywords: hepatoprotective activity, liver diseases, herbal drugs

Introduction
Liver disease is considered one of the main world health problems widespread in developing countries**.** The liver is the most important and essential organ in the body. multifunctional abilities involved in the metabolism of nutrients such as lipids, proteins, and carbohydrates, as well as in the excretion of waste metabolites. In addition, the liver is a primary target for toxins from the digestive system and is therefore involved in the breakdown and removal of toxins such as drugs and other foreign chemicals. Below we present the specific functions of the liver in the body. Liver failure is a metabolic disorder that is the most common cause of death and morbidity worldwide. Liver damage treatments have recently received worldwide attention due to the number of allopathic medicines and their toxic effects that lead to liver damage. Therefore, researchers have paid considerable attention to folk herbs that have the potential to protect the liver from liver damage or liver disease, primarily due to their low toxicity and healing efficacy. Recently, various folk herbs have been studied in animal experiments for their protective function of the liver. Traditional medicines are used to take advantage of the herb's beneficial effects on human health [1].

Hepatoprotective Activity of the Medicinal Plants
Bambusa bambos
Young bamboo shoots are used as Ayurvedic medicines in India. Young shoots contain various chemicals. components like choline, betaine, urease, cyanogenetic glycosides, oxalic acid and benzoic acid. It has an inflammatory agent, fertility, anti-inflammatory and antioxidant functions. In this studio *B. bambos* methanol extract was tested with carbon tetrachloride (CCl4) induced hepatotoxicity in rats. Female Wistar rats were divided into five groups; Group I served as a standard control. II-VI. Groups were administered Mixed with CCl4 olive oil in a 1: 1 ratio intraperitoneally (1 ml / kg of body weight) every 72 hours for 16 days. II It was a groupCCl4 negative control The IV. And Group V received methanol sprout extract mixed with olive oil, 200 mg and 400 mg /kg of body weight. In III. The group received 50 mg / kg silymarin once daily by mouth for 16 days. Methanol extract reduced the growth of aspartate amino transaminase (AST) and alanine amino transaminase. (ALT), as well as alkaline phosphatase (ALP) and all bilirubin that occurs in liver injury after CCl4 the injection. The results of the present study indicate that the reduction induced by *B. bambos* is performed with methanol extract. in rats at levels of ALT, AST, ALP and total bilirubin, indicating the hepatoprotective potential of the extract [2].

Melia azaderach
The leaves extracts of *Melia azaderach* against simvastatin-induced hepatotoxicity. Phytochemical screening of the extracts extracted from the leaves showed the presence of some active substances ingredients such as alkaloids, tannins, fluffiness, phenols, glycosides, steroids, terpenoids and flavonoids. The leaves of *Melia azedarach* were successively extracted with ethanol Simvastatin (20 mg / kg.p.o) induced hepatotoxicity using Silymarin standard drug (25 mg / kg). Significant changes in biochemical parameters (increase in serum glutamate) pyruvate transaminase (SGPT), serum glutamate oxaloacetate transaminase (SGOT), alanine phosphatase (ALP), serum bilirubin and reduced protein.) in simvastatin treated rats treated with *Melia azedarach* (300 mg / kg and 500 mg / kg) treated animals. Thus, the study defines the *Melia azaderach* leaf extract has significant hepatoprotective activity [3].

Cinnamomum zeylanicum
The inner bark of cinnamon (*Cinnamomum zeylanicum L.*) is generally seasoned and It has been widely used in the treatment and prevention of diseases. The purpose of this study is to evaluate the protective effect of cinnamon bark extract against carbon tetrachloride (CCl4) -induced liver injury in male Wistar rats. 28 days of application with cinnamon extracts (0.01, 0.05 and 0.1 g / kg) significantly reduced the effect of CCl4 toxicity serum markers of liver damage, aspartate aminotransferase, alanine aminotransferase and alkaline phosphatase. In addition,

cinnamon extract treatment significantly increases superoxide dismutase and catalase levels in rats. Histopathological studies in rat liver also confirmed that cinnamon extract significantly reduced CCl4 toxicity and preserved liver tissue histarchy close to normal levels. So here the results suggest that cinnamon extract acts as an effective liver protection agent in rats against CCl4-induced hepatotoxicity [4].

Zingiber officinale

Zingiber officinale is a conventional medicine for various disorders, including liver disease. The purpose of this study was to evaluate the hepatoprotective activity of ethanol extract of *Z. officinale* rhizome (ERZO) against thioacetamide-induced hepatotoxicity in rats. Five groups of male Sprague Dawley were used. In group 1, rats were injected intraperitoneally (ip) with normal saline and groups 2 to 5 were given thioacetamide (TAA, 200 mg / kg; ip) three times eight times a week to induce liver cirrhosis. seven. Group 3 received 50 mg / kg of silymarin. The rats in Groups 4 and 5 received 250 and 500 mg / kg ERZO (dissolved in 10% Tween). Hepatic injury was assessed macroscopically and microscopically for all groups. The results confirmed the induction of liver cirrhosis in group 2, while the administration of silymarin or ERZO significantly reduced the effect of thioacetamide toxicity. These groups are reduced liver fibrosists. Immunohistochemical evaluation of the proliferating nuclear antigen showed no significant proliferation in ERZO-treated rats compared to group 2. In addition, ERZO extract fractions were tested in Hep-G2 cells and showed anti-proliferative activity (IC50 38-60 µg / ml) This study demonstrated the hepatoprotective effect of ERZO [5].

Ocimum sanctum

Aqueous and alcoholic extracts of the *Ocimum sanctum* family: the lips were analyzed for the following parameters: serum AST, ALT, bilirubin, complete protein, LDH, liver weight and sleep time induced by hexobarbitone in mice with carbon tetrachloride. Both extracts (100 and 200 mg / kg, p.o.) significantly reduced serum levels of AST, ALT, bilirubin, and LDH, as well as hexobarbitone-induced sleep time, compared to the carbon tetrachloride group alone. Histopathological examination confirmed the hepatoprotective effect of *Ocimum sanctum* extract [6].

Curcuma longa

Background Hepatological research has focused on the development of conventional therapies such as cirrhosis of the liver. Therefore, this study evaluated the mechanism of hepatoprotective activity of ethanol extract of *Curcuma longa* rhizome (ERLC) in thioacetamide-induced liver cirrhosis in rats. Methods The hepatoprotective effect of CLRE was measured in a rat model of thioacetamide-induced liver cirrhosis for 8 weeks. Serum levels of hepatic cytochrome P450 2E1 as well as TGF-β1 and TNF-α were evaluated. Oxidative stress is measured by levels of malondialdehyde, 8-hydroxyguanosine, and nitrotyrosine in urine. The protective effects of CLRE free radical elimination mechanisms were investigated by antioxidant enzymes. Protein expression of proapoptotic Bax and anti-apoptotic Bcl-2 proteins in animal blood sera has been studied and confirmed using Bax immunehistochemistry, Bcl2 proteins and proliferating nuclear antigen. Results Liver histopathology, immunohistochemistry and biochemistry were significantly lower in the *Curcuma longa*-treated groups compared to controls. CLRE-induced apoptosis inhibited hepatic cell proliferation but had no effect on hepatic CYP2E1. Conclusion Progression of cirrhosis of the liver may be inhibited by the antioxidant and anti-inflammatory effects of CLRE and the maintenance of normal liver status [7].

Vitis vinifera

The ethanolic extract from the root of *Vitis vinifera* (Vitaceae) has been tested for liver protection in rats, which has been shown to cause liver damage with carbon tetrachloride. The 200 mg / kg oral extract showed significant protective effects by reducing serum SGPT, SGOT, alkaline phosphatase, and total bilirubin levels. At this dose, the extract increases the level of total protein. These biochemical observations were supplemented by histopathological examination of the liver sections. The activity of the extract was similar to that of silymarin, a known hepatoprotective drug [8].

Ginko biloba

The hepatoprotective effect of lyophilized methanolic leaf extract of *Ginkgo biloba* has been evaluated against lantaden-induced liver damage in guinea pigs. Reverse phase HPLC analysis of lantadines confirmed the presence of 72.82% lantadene A. UPLC-ESI-MS analysis showed that ginkgolide B, C, bilobalide, as well as ginkgolide traces A and J were found in *G. biloba* extract. The concentration of ginkgolide B in the sample was 0.29%. Significant normalization of serum alanine aminotransferase, aspartate aminotransferase, and alkaline phosphatase due to lantadene was restored in a dose-dependent manner with *G. biloba* extract. The effects of lanthanum and *G. biloba* extract on lipid peroxidation (LPO), reduced glutathione (GSH), superoxide dismutase (SOD) and catalase were analyzed in liver homogenates to assess antioxidant activity. In a dose-dependent manner, *G. biloba* extract significantly reduced Lantaden-induced increase in LPO levels. Reduced levels of lantadene-induced SOD, GSH and catalase were increased by *G. biloba* extract. The findings of biochemical enzymes and antioxidants are supported by crude and histopathological observations. In addition, liver sections of the *G. biloba* group showed a significant reduction in apoptosis compared to the lantadene group. This study suggested that *G. biloba* could be used as a promising hepatoprotector against lanthamide-induced liver injury. Future studies are needed to clarify the exact mechanism of hepatoprotection in practice [9].

Piper longum

The ethanol extracts of the *Piper longum* fruits and five different crude fractions, petroleum ether (40-60 ° C), solvent ether, ethyl acetate, butanol and butanone, were previously subjected to qualitative chemical tests. The ethanol extract and all other fractions were examined orally for liver protection in adult Wistar rats. The ethanolic extract and the butanol fraction showed significant activity, reducing the serum enzymes glutamine oxaloacetic transaminase and pyruvic glutamic transtase in rats treated with carbon tetrachloride compared to rats treated with control and Liv-52 [10].

Accacia catechu

Study of the hepatoprotective activity of *Acacia Catechu*, extract of ethyl acetate katha. Methods: Acute liver damage was induced in albino rats by subcutaneous administration of 4 ml / kg in olive oil at 50% (v / v) and chronic liver damage by subcutaneous injection at 50% v / v. v tetrachloride in olive oil at a dose of 2 ml / kg twice a week for 14 days. The hepatoprotective activity was biochemically controlled by estimating serum hansaminase, serum alkaline phosphatase and serum bilirubin, in both cases after intraperitoneal injection of ethyl acetate extract "katha" (250 mg / kg). Histopathological changes in liver samples were compared with controls. Results: "Katha" ethyl acetate extract inhibited carbon tetrachloride-induced liver toxicity in albino rats at 250 mg / kg body weight. evaluated on the basis of biochemical and histopathological values. Conclusion: the ethyl acetate extract of "Katha" showed a significant hepatoprotective effect [11].

Tylophora indica

Investigation of hepatoprotective activity of alcoholic (ALLT) and aqueous (AQLT) extracts of *Tylophora indica* (asclepiadaceae) leaves against ethanol-induced hepatotoxicity.

Materials and Methods: *Tylophora indica* leaf powder was extracted sequentially with alcohol and water. Preliminary phytochemical tests were performed and LD50 values were determined for both extracts. Hepatoprotective activity of ALLT and AQLT was evaluated in ethanol-induced hepatotoxic rats. Results: ALLT showed the presence of alkaloids, carbohydrates, steroids, saponins and triterpenes, and the presence of alkaloids, carbohydrates and saponins in AQLT. The ALLT did not even cause mortality at 5000 mg / kg, whereas the AQLT LD50 was 3162 mg / kg. Ethanol caused significant changes in physical (increase in liver weight and volume), biochemical (serum alanine transaminase, aspartate transpartase, alkaline phosphatase, direct bilirubin, total bilirubin, cholesterol, triglycerides). proteins and albumin), histology (damage to liver cells) and functional liver parameters (thiopentone-induced sleep time). Pretreatment with ALLT or AQLT extract significantly prevented ethanol-induced physical, biochemical, histological and functional changes in the liver.

Conclusion: This study indicates that the ALLT and AQLT extracts had hepatoprotective activity. The alcoholic extract was found to have a higher protective effect than the aqueous extract [12].

Andrographis paniculata and ***swertia chirayita***

Andrographis paniculata (family Acanthaceae) and *Swertia chirayita* (family Gentianaceae) are two controversial herbs used as Kiriyattu that have similar therapeutic effects and are used as hepatoprotective and hepatostimulatory agents. *A. paniculata* grows in southern India and *S. chirayita* in the Himalayan region. The present work relates to the ability of extracts of these plants to protect against acetaminophen-induced acute hepatotoxicity (150 mg / kg) in Swiss albino mice. Oral administration of *A. paniculata* or *S. chirayita* extract (100-200 mg / kg) provided significant dose-dependent protection against paracetamol-induced hepatotoxicity as assessed by biochemical and histopathological parameters. Paracetamol has been shown to increase serum marker enzymes such as glutamate pyruvate transaminase (GPT), serum glutamate oxaloacetate transaminase (GOT), alkaline phosphatase (ALP) and bilirubin in peripheral blood serum and increased liver tissue. lipid (LPO) and superoxide dismutase (SOD), catalase, reduced glutathione (GSH) and glutathione peroxidase (GPx) in liver tissue. Administration of the plant extracts after paracetamol injury repaired the level of these parameters to treat the level (untreated). Thus, the present study revealed that extracts of *A. paniculata* or *S. chirayita* provided protection against paracetamol-induced hepatotoxicity [13].

Boerhaavia diffusa

Oral alcohol extract from the whole *Boerhaavia diffusa* plant showed a hepatoprotective effect against experimentally induced carbon tetrachloride hepatotoxicity in rats and mice. The extract also increases normal bile flow in rats, suggesting strong choleretic activity. The extract was not toxic when administered to mice at an oral dose of 2 g / kg [14].

Baliospermum montanum

Rats and primary cultures of rat liver cells were used in in vivo and in vitro models to assess the hepatoprotective activity of whole methanol extract subfractions of *Baliospermum montanum*. Carbon tetrachloride was chosen as hepatotoxin. Silymarin was the reference hepatoprotective agent. In the in vivo study, serum transaminases, alkaline phosphatase, total bilirubin, total cholesterol, albumin, and total protein, and histopathological examination were criteria for evidence of liver failure. Carbon tetrachloride altered all biochemical parameters and centrilobular necrosis. The tested methyl methyl ketone and methanol subfractions (50, 100, and 150 mg / kg), the methanol subfractions of the total bioactive methanol extract (150 mg / kg), and silymarin (100 mg / kg) improved the liver. cell recovery by restoring all biochemical parameters altered by normalization. In the in vitro study, transaminase release, all proteins together, and liver cell viability were the criteria. Primary liver cell cultures were treated with carbon tetrachloride (10 µl / ml) and the various fractions of ethyl methyl ketone and methanol (100, 500 and 1000 µg / ml) were treated with total extracts of methanol and silymarin (100 µg / ml).)). Carbon tetrachloride reduced the viability of liver cells and also altered biochemical parameters, which were significantly restored ($P < 0.05$) by the sub-fractions of ethyl methyl ketone (1000 µg / ml) and methanol (500 and 1000 µg / ml). These results suggest that *Baliospermum montanum* has hepatoprotective activity against carbon tetrachloride-induced liver damage in both rats and primary cultures of rat liver cells [15].

Conclusion

Medicinal plants are always beneficial for mankind by resolving the health issues. Liver is the most crucial and indispensable organ in the body with multifunctional capabilities. It is involved in the metabolism of nutrients such as lipids, proteins, and carbohydrates, as well as in the excretion of waste metabolites.] In recent times, most of the hepatoprotective drugs available in the market for use against different kinds of liver diseases have plant-based origins, either as single plant preparations or as polyherbal mixtures. Folkloric herbs play an essential role in improving the quality of life

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