HEPATOPROTECTIVE HERBAL POTENTIALS OF AYURVEDA

Harshitha Kumari¹, Reshmi Pushpan¹, Rahul Dutt K², Nishteswar. K³

¹ Ph D Scholar, Department of Dravyaguna, IPGT&RA, GAU, Jamnagar, 361008.
² M.Pharm Scholar, Department of Pharmaceutical Sciences, Saurashtra University, Rajkot, 360005.
³ Professor and Head, Department of Dravyaguna, IPGT&RA, GAU, Jamnagar, 361008.

ABSTRACT
Liver disorders like viral hepatitis, cirrhosis, alcoholic liver disease, fatty liver, jaundice etc do not have specific treatment modalities in modern medicine even though they are the cause for death and secondary complications among the population of developed and developing countries. The traditional systems of medical practice in several parts of the world constitute several hepatoprotective herbs. Extensive researches have been carried out in different parts of the world on single herbal drugs and formulations delineated in Ayurvedic texts to explore the mode of protection of liver from causative factors like virus, alcohol and other toxins. Drugs like Andrographis paniculata, Boerhavia diffusa, Eclipta alba, Plumbago zeylanica, Swertia chirayita etc have studied extensively in this regard which has been reviewed in the present article. Research on Andrographis paniculata, Plumbago zeylanica etc has evidenced the Ayurvedic claim of protective and curative effect when drug is used as a whole.
Keywords: viral hepatitis, hepatoprotective herbs, Andrographis paniculata, Plumbago zeylanica.

INTRODUCTION
In all age groups liver disorders have been recognized as an important cause of morbidity and mortality. Liver being the largest organ of the body plays an important role in the metabolism of food as well as drugs. Liver can be invaded by several toxins, microorganisms and alcohol. The prevalence of alcoholic liver disease is increasing worldwide leading to more than 2,00,000 deaths every year and is the 4th leading cause of death in USA.[1]

In India, alcoholic liver disease comprises more than 60 percent of all patients with chronic liver diseases due to alcohol. Viruses like A, B, C, D, E are responsible for hepatitis in humans. Other viruses which cause hepatitis includes cytomegalovirus.
Hepatitis C virus is being recognized as an important cause of hepatocellular carcinoma, which is the 7th most common cancer worldwide.\textsuperscript{[2]}

The description of \textit{yakrit}, located in the right side of the thoraco-abdominal cavity in Ayurvedic classics is interpreted as liver, which is considered to be the seat of \textit{ranjaka pitta} (component of \textit{pitta} responsible for \textit{rakta} formation). The diseases related to \textit{yakrit} are referred to as \textit{yakritdalyodara}, \textit{kamala}, \textit{kumbhakamala} etc. Some of the symptoms recorded by Charaka under \textit{grahani roga} (a syndrome) appear to be related to cirrhosis of the liver.\textsuperscript{[3]} Charaka and Susruta have described treatment modalities for \textit{kamala} (jaundice including viral hepatitis). The medieval Ayurvedic works have recorded the efficacy of single as well as simple herbal recipes in the management of \textit{kamala}.

During 20th century, Ayurvedic physicians, modern pharmacologists and phytochemists have attempted to document experimental as well as clinical evidences with regard to hepatoprotective medicinal plants. Notable observations made on few of the important medicinal plants which are frequently mentioned in Ayurvedic classics are enumerated in this review.

\textbf{MATERIAL AND METHODS}

1. Herbs mentioned in the treatment of \textit{Kamala} (Jaundice) were collected from classical Ayurvedic texts like \textit{Bruhatrayis} (Charaka Samhita, Sushruta Samhita, Ashtanga Hrudaya) and texts like \textit{Bhavaprakasha}, \textit{Yogaratnakara} etc.

2. The drugs quoted repeatedly were investigated for researches in the direction of hepatoprotection from different sources like internet, publications from CCRAS, ICMR etc

3. Details of pharmacological and clinical research profiles are summarized and tabulated.

\textbf{Observations}

1. \textit{Andrographis paniculata} (Burm.) Wall. Ex Nees (Acanthaceae) - Bhunimba

Pharmacological study-The aqueous extract of \textit{A. paniculata} increased biliary flow and liver weight in rats and decreased the duration of hexabarbitone induced sleep in mice.\textsuperscript{[4]}
also single dose of leaf aq. extract administered 4h before intoxicating the rats with CCl₄ (5ml/kg oral) has been shown to decrease CCl₄ induced hepatic microsomal lipid peroxidation.[⁵] A. paniculata has protective as well as curative effect on alcohol induced toxic liver damage in comparision with andrographolide which demonstrated a protective action against CCl₄ induced increase in serum transaminase activity in rats.[⁶] Another study showed A. paniculata liquid extract produced stronger immunostimulation compared to isolated andrographolide. In this study it is also observed that both (whole drug and andrographolide) stimulated antigen specific and non-specific immune responses in mice.[⁷]

Clinical trial- Decoction of A. paniculata 60 ml per day (equivalent to 40 g of crude drug) in three divided doses for 23 ± 4 d in human clinical trials (60 patients with hepatocellular jaundice) revealed that yellow color of the conjunctiva improved 100 percent, tender hepatic enlargement decreased in 90 percent of patients within 20 d of treatment. Loss of appetite in 100 percent was improved after 4-5 d. Several tests for biochemical markers such as serum bilirubin, alkaline phosphatase and serum transferase were highly significant after the treatment.[⁸]

Pharmacokinetics - Oral doses of radio-labelled andrographolide given to mice were rapidly absorbed and distributed to organs, especially gall bladder, kidney, ovary and lungs. Andrographolide levels appeared to be low in spleen, heart and brain. Approximately 90 percent was excreted in the urine and faeces after 24h and 94 percent after 48h. At 48 h, radio-labelled andrographolide only accounted for approximately 11 percent of urine and liver fractions, the remainder consisting of metabolites.[⁹]

2. Azadirachta indica A. Juss. (Meliaceae)-Nimba

Pharmacological study- Aqueous extract of neem leaves and fresh juice from tender leaves showed hepatoprotective activity in paracetamol induced hepatotoxicity in rats. [¹⁰]

3. Berberis aristata (Berberidaceae)- Daruharidra

Pharmacological study- Isoquinoline alkaloid berberine on CCL₄ induced hepatotoxicity in mice suppressed elevated serum levels of alanine aminotransferase (ALT),
aspertaseaminotransferase (AST) and alkaline phosphatise (ALP) in a concentration dependent manner. The decrease in hepatic activity of superoxide dismutase and an increase in lipid peroxidation were significantly prevented by berberine. Histopathological changes were reduced and the expression of tumor necrosis factor-α, cyclooxygenase-2 and inducible nitric oxide synthase was markedly attenuated by berberine 10mg/kg. The results indicate that berberine could be effective in protecting the liver from acute CCL\textsubscript{4} induced injury.\[11\]

4. Boerhavia diffusa Linn. (Nyctaginaceae)- Punarnava

Pharmacological study- The methanolic and chloroform extracts of the roots and aerial parts exhibited antihepatotoxic activity against carbon tetrachloride intoxication in rats.\[12\] 50 percent ethanolic extract on country made liquor induced hepatotoxicity in albino rats showed hepatoprotective effect evidenced by changes in serum alanine aminotransferase(ALT), triglycerides, cholesterol and total lipid levels in both serum and tissues. Histopathological studies showed marked reduction in fat deposits in animals receiving B. diffusa along with country made liquor.\[13\]

5. Curcuma longa Linn. (Zingiberaceae)- Haridra

Pharmacological study- Hepatoprotective effect of turmeric extract on carbon tetrachloride induced liver damage in rats revealed considerable reduction in serum bilirubin, cholesterol, aspartate, aminotransferase and alkaline phosphatase elevated by carbon tetrachloride.\[14,15\] Curcumin has been reported to strongly inhibit cytochrome 450IA in liver, an isozyme involved in the bioactivation of several toxins including benzo[α]pyrene.\[16\]

Pharmacokinetics- Pharmacokinetic study in rats indicates that the absorption of pure curcumin from gastrointestinal tract is about 60-65 percent after administration of a single oral dose of 400 mg/kg. About 40 percent of the administered dose was recovered unchanged in the faeces over a period of 5d with a peak after 3 d. Free curcumin was not detected in urine but excretion of glucuronic acid sulphate conjugates was observed from day 1 to day 7, suggesting an entero hepatic circulation.\[17,18\]
6. Cyperus rotundus (Cyperaceae)- Musta

Pharmacological study- Methanol extract of rhizome at a dose of 670 mg/kg administered to mouse orally is active in CCl₄ treated mice. Dried tuber also showed marked hepatoprotective activity against CCl₄ induced hepatotoxicity. [19] The ethyl acetate extract at an oral dose of 100 mg/kg exhibited a significant protective effect by lowering serum levels of glutamic oxaloacetic transaminase, glutamic pyruvic transaminase, alkaline phosphatase and total bilirubin. [20]

7. Eclipta alba (Linn.) Linn. (Asteraceae)- Bhringaraja

Pharmacological study- In vitro immune-activation of surface antigen of hepatitis B virus (HBsAg) by E. alba has been reported. [21,22] Liquid extract of fresh leaves shown hepatoprotective properties against acute carbon tetrachloride induced liver damage in guinea pigs. [23] Ethanol:Water (1:1) extract significantly reversed the carbon tetrachloride induced inhibition of the hepatic microsomal drug metabolizing enzyme amidopyrine N-demethylase and membrane bound glucose 6-phosphatase. [24]

Clinical trial- E. alba powder 50mg/kg with honey in three divided doses for a period of 1-5 wk recovered fully in 80 percent of children of Hepatitis taken for study and 100 percent cure in patients of infective hepatitis was observed in different studies. [25, 26]

8. Embelia ribes (Myrsinaceae)- Vidanga

Pharmacological study- Embelin orally (25 mg/kg) from day 1 to day 15, peroxidative damage was minimal in both liver and serum along with effectively inducing the antioxidant potential in CCl₄-treated male wistar rats. The biochemical results were compared with the standard drug silymarin – a combination of flavonolignans of Silybum marianum and histology of liver sections. [27]

9. Emblica officinalis Gaertn.(Euphorbiaceae)- Amalaki

Pharmacological study- Fruit extract shown to counteract metal ion toxicity and also does hepatoprotection against CCl₄ induced liver toxicity in rats. [28] Also fruit extract in dose of 100-200 mg/kg increased cell variability of rat hepatocytes being treated with
paracetamol (2g). Results indicate that the drug have the ability to rectify hepatic damage or toxicity.\textsuperscript{[29]}

10. Glycerrhiza glabra Linn. (Fabaceae)- Yashtimadhu

Pharmacological study- Glycerrhiza flavonoids provided protection to hepatocytes exposed to carbon tetrachloride and galactosamine in mice. Anti-lipid peroxidation effect as the central mechanism contributing to its protective action against CCl\textsubscript{4} induced hepatotoxicity was pointed in this work.\textsuperscript{[30,31,32]}

Clinical trial- Glycyrrhizin protected the liver apparently through its membrane stabilization effect and also decreases the increased plasma levels of aminotransferase(AST) and alanine aminotransferase (ALT) in patients with chronic hepatitis or during inflammation.\textsuperscript{[33,34,35]} Glycyrrhizin is showed statistically significant improvement in acute and chronic cases of hepatitis in a randomized controlled clinical trial in 88 patients.\textsuperscript{[36]}

Pharmacokinetics- The pharmacokinetic behavior of glycyrrhizin was examined in D-galactosamine intoxicated (GAL) rats. After oral administration, glycyrrhizin is metabolized predominantly in the liver and removed from the body via the bile. Better absorption and higher plasma concentration might be achieved by administering glycyrrhizin alone rather than in licorice extract. Significantly lower concentration of glycyrrhizin was found in bile samples from rats treated with licorice extract compared to pure glycyrrhizin.\textsuperscript{[3,38]}

11. Luffa echinata Roxb (Cucurbitaceae)- Devadali

Pharmacological study- Aqueous extract of L.echinata fruits significantly lowered the serum bilirubin level in chlorpromazine induced jaundice in rats. The alcoholic extract showed definite protection against carbon tetrachloride induced liver injury in rats.\textsuperscript{[39]}

Clinical trial- Single administration of drops squeezed from watersoaked dry fruits into the nostrils significantly reduced bilirubin and SGPT levels within 3 to 7 days with substancial relief in clinical symptoms like anorexia and malaise.\textsuperscript{[40]}

12. Phyllanthus amarus Schum. & Thonn. (Euphorbiaceae)- Bhumyamalaki
Pharmacological study- Methanolic extract of leaf significantly increased the levels of glutathione (GSH), superoxide dismutase (SOD), and catalase (CAT) in the liver which were markedly reduced due to ethanol-induced oxidative damage. Lipid peroxidation was also significantly reduced by the administration of drug.[41] Drug is also reported for having anti-HBV activities, [42] inhibition of HBV enhancer I resulting suppression of HBV messenger ribonucleic acid (mRNA) synthesis [43] and decrease serum levels of woodchuck hepatitis surface antigen and DNA polymerase in animals chronically infected with woodchuck hepatitis virus.[44,45]

Clinical trial- P. amarus powder administered in capsule form (600mg/d) showed 59 percent of the treated subjects to lose HBsAg at the first follow up visit and remained cleared for several months after the end of the treatment. [46] Chronic HBV carriers treated with 750 mg/day of P.amarus for 3 months revealed loss of HBsAg which remained negative nine months after treatment was discontinued. [47]

13. Picrorhiza kurroa Royle ex Benth. (Scrophulariaceae) - Katuki
Pharmacological study- P.kurroa has shown hydrocholeretic effect in rats and dogs,[48] antinecrotic effect in carbon tetrachloride-induced damage in rats and rabbits,[49] reduces fatty infiltration and lipid deposits in galactosamine-induced liver damage,[50] reduces paracetamol induced hepatic damage,[51] scavenging of superoxide anions and inhibition of lipid peroxidation and antiviral effect on vaccinia viruses.[52]

Clinical trial- A double blind study with placebo control showed total clearance of bile salts, bile pigments, serum bilirubin from the blood when patients treated with 500 mg dose of powder twice daily.[53] Decoction given orally thrice a day for four weeks to patients of infective hepatitis reported significant improvement with respect to serum bilirubin, serum alkaline phosphatase, SGOT, SGPT, serum total protein, serum albumin in drug treated group of patients with no side or toxic effects during study.[54]

14. Piper longum Linn. (Piperaceae)- Pippali
Pharmacological study - Following treatment with Piper longum milk extract (200 mg/day p.o. for 21 days), a significant hepatoprotective effect was observed in CCl4
induced hepatic damage as evident from decreased level of serum enzymes, total bilirubin and direct bilirubin. The hepatoprotective effect of *Piper longum* is comparable to the standard drug silymarin (25 mg/kg/day p.o. for 21 days).[55]

15. Plumbago zeylanica Linn. (Plumbaginaceae)-Chitraka

**Pharmacological study-** Hepatoprotective activity of methanolic extract of the roots in the dose of 500mg/kg was carried out. Activities of pure plumbagin and plumbagin free methanolic extract were compared in rats intoxicated with carbon tetrachloride in order to ascertain the antihepatotoxic activity of the methanolic extract was due to plumbagin or due to the constituents other than plumbagin. There was no significant effect on biochemical parameters elevated by *CCL4* intoxication by plumbagin or plumbagin free methanolic extract. But methanolic extract with traces of plumbagin showed significant protection against *CCL4* hepatic injury in rats. [56] Petroleum ether extract of root showed significant reduction in the serum markers elevated in rats treated with paracetamol indicating the effect of plant extract in restoring the normal functional ability of the hepatocytes.[57]

16. Swertia chirayita Karst. (Gentianaceae) -Karatatikta

**Pharmacological study-** Treatment with *S.chirayita* and carbon tetrachloride caused improvement at both the biochemical and histopathological parameters versus carbon tetrachloride treatment alone.[58] The methanolic extract found to be active against *CCL4*, galactosamine and paracetamol induced liver toxicity in experimental rats and on fractionation into butanol-soluble and chloroform-soluble fractions, the antihepatotoxicity was traced and found to be more profound in chloroform-soluble fraction.[59]

17. Tephrosia purpurea Linn. (Fabaceae)- Sharapunkha

**Pharmacological study-** Drug exhibited potent hepatoprotective effect against *CCL4* induced acute and chronic liver damage. It inhibited triglyceride accumulation in hepatic cells and protects liver against increased hydroxyproline content. It also has anticholestatic property. [60] Dried ethanolic extract of *Tephrosia purpurea* was studied
for its efficacy using both acute (D-galactosamine) and chronic models CCl4 of experimentally induced hepatotoxicity. In vitro studies exploiting trypan blue exclusion assay revealed that the alcoholic extract exerted a significant hydroxyl radical scavenging activity. [61]

18. Terminalia beiera Roxb. (Combretaceae)- Vibhitaki
Pharmacological study- Treatment with T. bellerica extract (200, 400 and 800 mg/kg, p.o.) and gallic acid (50, 100 and 200 mg/kg, p.o.) showed dose-dependent recovery in the biochemical parameters like serum transaminase, serum alkaline phosphatase, glutathione, adenosine triphosphatase and succinic dehydrogenase against carbon tetrachloride intoxication in albino rats. The effect was more pronounced with gallic acid. [62]

19. Tinospora cordifolia (Willd.) Miers ex Hook.f. & Thoms. (Menispermaceae)- Guduchi
Pharmacological study- Ethanolic extract of T. cordifolia stem exhibits hepatoprotective effect in carbon tetrachloride induced hepatotoxicity in mice, rats and rabbits. [63] Drug also showed significant improvement in Kupffer cell function. [64]
Clinical trial – T. cordifolia has been shown to have hepatoprotective and immunomodulatory properties, on surgical outcome in patients with malignant obstructive jaundice. Group containing T. cordifolia along with conventional management has shown phagocytic and killing capacities of neutrophils normalized which was not seen in group receiving only conventional management. [65,66]

20. Terminalia chebula Retz. (Combretaceae)- Hareetaki
Pharmacological study- An aqueous extract of fruit of T. chebula on the tert-butyl hydroperoxide (t-BHP)- induced oxidative injury observed in cultured rat primary hepatocytes and rat liver significantly reversed the t-BHP-induced cell cytotoxicity and lactate dehydrogenase leakage. In addition, extract exhibited in vitro ferric-reducing antioxidant activity and 2,2-diphenyl-1-picrylhydrazyl free radical-scavenging activities. Histopathologic examination of the rat livers showed that TCE reduced the incidence of
liver lesions, including hepatocyte swelling and neutrophilic infiltration, and repaired necrosis induced by t-BHP. Based on the results described above, we speculate that TCE has the potential to play a role in the hepatic prevention of oxidative damage in living systems.\textsuperscript{[67]}

21. Trichosanthes dioica Roxb (Cucurbitaceae)- Patola

Pharmacological study- Ethanolic and Aqueous extracts of TD at different doses (100, 200 and 400 mg/kg) and silymarin (100 mg/kg) were administered orally for 10 days. TD-200e showed decrease in the levels of AST (p<0.01), ALT, TB, ALP and increase in TP (p<0.05). TD-200a showed significant decrease in the levels of AST, ALT, TB, ALP and increase in TP levels. The groups treated with 400 mg/kg aqueous and ethanolic extract showed significant (p<0.01) reduction in AST, ALT, ALP, TB and increase in TP level. The pretreatment with TD extracts showed profound histopathological protection to liver cells as evident from histopathological studies.\textsuperscript{[68]}

<table>
<thead>
<tr>
<th>TABLE 1: SUMMARY OF PHARMACOLOGICALLY ACTIVE HEPATOPROTECTIVE DRUGS.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Drug</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>No.</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>11</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td>13</td>
</tr>
</tbody>
</table>
| 14| Chitraka Plumbago | Root Methanolic | CCl₄ induced hepatic | Functional improvement of
<table>
<thead>
<tr>
<th></th>
<th>Name</th>
<th>Extract</th>
<th>Injury in rats.</th>
<th>Hepatocytes may be by an accelerated regeneration of parenchymal cells. Early improvement in the secretory mechanism of the hepatic cell.</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Kiratatikt a</td>
<td>Swertia chirayita</td>
<td>Whole plant Methanolic extract CCl₄ induced hepatotoxicity and hepatocytic necrosis in rats.</td>
<td>Decreased serum aspartate aminotransferase, alanine aminotransferase and alkaline phosphatase activities and bilirubin level.</td>
</tr>
<tr>
<td>16</td>
<td>Sharapun kha</td>
<td>Tephrosia purpurea</td>
<td>Aerial parts Ethanolic extract CCl₄ induced acute and chronic liver damage in rats.</td>
<td>Inhibited triglyceride accumulation in hepatic cells and protects liver against increased hydroxyproline content.</td>
</tr>
<tr>
<td>17</td>
<td>Guduchi</td>
<td>Tinospora cordifolia</td>
<td>Stem Ethanol extract CCl₄ induced hepatotoxicity in mice, rats and rabbits</td>
<td>Modulation of Kupffer cell activity.</td>
</tr>
<tr>
<td>18</td>
<td>Hareetaki</td>
<td>Terminalia chebula</td>
<td>Fruit Aqueous extract tert-butyl hydroperoxide (t-BHP)-induced oxidative injury</td>
<td>Reversed t-BHP-induced cell cytotoxicity and lactate dehydrogenase leakage, reduced the incidence of liver lesions, including hepatocyte swelling and neutrophilic infiltration and repaired necrosis induced by t-BHP.</td>
</tr>
</tbody>
</table>
### Vibhitaki Terminalia belerica Fruit Water extract CC<sub>4</sub> intoxication in albino rats

Recovery in the biochemical parameters like serum transaminase, serum alkaline phosphatase, glutathione, adenosine triphosphatase and succinic dehydrogenase.

### Patola Trichosanthes dioica Whole plant Ethanolic and Aqueous extracts Ferrous sulphate-induced liver injury

Reduction in AST, ALT, ALP, TB and increase in TP level.

### Pippali Piper longum Fruit and root milk extract CC<sub>4</sub> induced hepatic damage

Decreased level of serum enzymes, total bilirubin and direct bilirubin.

---

**TABLE 2: SUMMARY OF HEPATOPROTECTIVE DRUGS WITH PROVEN CLINICAL EFFICACY.**

<table>
<thead>
<tr>
<th>Sl no</th>
<th>Drugs</th>
<th>Botanical name</th>
<th>Part used</th>
<th>Form</th>
<th>Dose and duration</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bhunimba</td>
<td>Andrographis paniculata</td>
<td>Leaf</td>
<td>Decoction</td>
<td>60 ml/day</td>
<td>Serum bilirubin, alkaline phosphatase and serum transferase were highly significant.</td>
</tr>
<tr>
<td>2</td>
<td>Bhringaraja</td>
<td>Eclipta alba</td>
<td>Plant</td>
<td>Powder</td>
<td>50mg/kg with honey for 1-5 wk</td>
<td>100 percent cure in patients of infective hepatitis.</td>
</tr>
<tr>
<td>3</td>
<td>Yashtimadhu</td>
<td>Glycyrrhiza glabra</td>
<td>Glycyrrhizin</td>
<td>4mg/day</td>
<td>4 weeks</td>
<td>Prevents development of hepatocellular carcinoma in chronic hepatitis C.</td>
</tr>
<tr>
<td>5</td>
<td>Devadali</td>
<td>Luffa</td>
<td>Water soaked dry</td>
<td>Juice</td>
<td>Drops</td>
<td>Reduced bilirubin and</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Bhumyamalaki</td>
<td>Phyllanthus amarus</td>
<td>Wholeplant Powder</td>
<td>Capsule form (600 mg/day)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Loss of HBsAg which remained negative nine months after treatment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>750 mg/day for 3 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Katuki</td>
<td>Picrorhiza kurroa</td>
<td>Root Decoction</td>
<td>500 mg dose of twice daily for four weeks</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Significant improvement in serum bilirubin, serum alkaline phosphatase, SGOT, SGPT, serum total protein, serum albumin.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Guduchi</td>
<td>Tinospora cordifolia</td>
<td>Stem Powder</td>
<td>16 mg/kg/day</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Phagocytic and killing capacities of neutrophils normalized.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION AND CONCLUSION

There are various conditions in clinical practice where one can find modern medical agents inadequate either from efficacy or safety or compliance point of view. Common such refractory conditions encountered in the practice of internal medicine are liver disorders, arthritis, diabetes, obesity, cancer etc.

In the world medical history Charaka samhita for the first time recorded about the observations made by Acharyas of Ayurveda with regard to the pigmenting substance (stercobilinogen) which is responsible for the color of faecal matter while discussing about the recovery signs of jaundice. [69] Charaka has advocated the drugs namely Katuki (Picrorhiza kurroa), Haridra (Curcuma longa), Triphala (Three myrobalans), Guduchi (Tinospora cordifolia), Daruharidra (Berberis aristata) and Nimba (Azardirachta indica) as prime drugs for the management of jaundice (Kamala). [70] Later works like Nighantus and other texts have added the herbs like Vasa (A.vasika), Bhumyamalaki (P.amarus),
Kumari (Aloe vera), Devadali (L.echinata), Bhunimba (A. paniculata)\textsuperscript{[71]} to the formulations indicated in the management of liver disorders.

Involvement of liver in pitta dominating disorders is well known. For eg. Symptoms of Udara especially Pittodara and Yakritdalyodara, Kamala, Kumbhakamala, Haleemaka etc shows liver is affected in these conditions. The drugs mentioned in the classical texts which have proven hepatoprotective activity are pittahara mainly.

Drug like Tamalaki or Bhumyamalaki (P. amarus) has not included in the chapter explaining treatment of Kamala by Acharyas like Charaka and Sushrutha but it is indicated in pitta predominant jwara, gulma, kasa etc and formulations containing Tamalaki is been considered in treating Kamala, Haleemaka, Pandu, Jwara etc. This is being noted and documented by Yogaratnakara (a 17\textsuperscript{th} century work), who brought the drug into main stream of treatment of liver disorders which paved the way for various researches and successful management of jaundice.

Eventhough Katuki (P. kurroa) is included in formulations of Kamala treatment, it is Yadavji Trivikramji Acharya who made the drug popular for the management of Kamala. Since then most of the practitioners of Ayurveda started prescribing Arogyavardhini Rasa, which was originally formulated by Rasavagbhta for the management of Kushta (skin disorders). Recent researches have also confirmed hepatoprotective and choleretic activities of Katuki.

The drugs mentioned in Ayurveda not only prevent liver damage but can also reverse the damage occurred as evidenced by the above studies through different modes of action along with anti oxidant property and immune stimulation. It can also be noted that drugs like Daruharidra and Bhunimba having Bhedana action enhance excretion of bilirubin relieving obstructive jaundice. It is also seen that research which combined ancient Ayurvedic healing principles with the dialysis procedures of modern medicine in an immunologic setting has given fruitful result in controlling viral Hepatitis B disease.\textsuperscript{[72]}

A critical analysis of the research studies clearly indicates that whole drug is preferred to its isolated active principle. Hepatoprotective activity of P. zeylanica was demonstrated
only when drug was administered as a whole. The liver protective and curative effect of 
A. paniculata extract compared to isolated andrgrapholide also supports this observation. 
Administration of drug through nasal mucus membrane in the management of jaundice as 
suggested by Ayurveda was ridiculed by western scientists. But clinical research carried 
out at Pune medical college [38] confirmed that the drug administered as nasal drops 
brings down the elevated serum bilirubin level significantly which revalidates the claim 
recorded in the Ayurvedic classics.

The research organizations like CCRAS, ICMR have conducted meticulous studies and 
produced evidence based data of hepatoprotective herbs and other herbal formulations 
mentioned in the classics of Ayurveda. These findings lend support to establish that the 
age old Ayurvedic health practices are comprehensive and more suitable to address the 
contemporary healthcare problems.

REFERENCES

1. Diehl AM. Toxic liver injury. Annual post graduate course. American college of 
   Gastroenterology 1993;461-74.
4. Chaudhuri S K. Influence of Andrographis paniculata on bile flow and 
5. Choudhary BR, Podddar MK. Andrographolide and Kalmegh (Andrographis 
   paniculata) extract: in vivo and in vitro effect on hepatic lipid peroxidation. Methods 
6. Chodhary BR, Podddar MK. Effect of alchohol induced liver damage in rats by 
8. Tomar GS, Singh RN. Treatment of hepatocellular jaundice with Kalmegh 


41. Hepatoprotective potentials of *Phyllanthus amarus* against ethanol-induced oxidative stress in rats, Faremi Toyin et al, Food and chemical toxicology, 2008;46:2658-64.


60. Sabnis Mukund. Chemistry and pharmacology of Ayurvedic medicinal plants, Chaukhambha Amarabharati Prakashan, Varanasi, 2006;137.


For Correspondence:
Harshitha Kumari
Email: drharshitharai@gmail.com