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Hepatoprotective Potential of the Medicinal Herbs: An Updated Review.

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ABSTRACT:
Majority of the physiological and metabolic activities and the detoxification of different drugs and chemicals are performed by the liver. But it is always prone to different diseases as the detoxification of the detrimental chemicals takes place in it. Drug Induced Hepatotoxicity (DIHT) is a burning issue in medical science and that is why many drugs are banned due to their hepatotoxic activity. In many medicinal systems different herbal plants are used as hepatoprotective agents and are being tested for their hepatoprotective ability. Therefore in this review work emphasis was given on to consolidate the available data of a group of hepatoprotective plants, their parts used in hepatoprotection.

KEY WORDS: *Liver, physiological, metabolic, detoxification, hepatoprotective.*

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I. INTRODUCTION:

In humans liver being the largest organ contributes in majority of the physiological activities like growth, nutrition, immunity and energy metabolism. It also performs synthesis and excretion of bile, albumin, prothrombin and produces compliments. But liver is always prone to diseases as the detoxification of the detrimental chemicals takes place in it. Taking of alcohol, viral infections and hepatocarcinoma also damage the liver. Presently the liver damage caused by Drug Induced Hepatotoxicity (DIHT) is a subject of concern for medical science and that is why many drugs readily available in the market are banned because of their hepatotoxic activities. During DIHT, intense oxidative stress is caused because of the formation of inflammation aggrevating cytokines and reactive free radicals from the hepatic neutrophils and Kupffer cells[75]. In many medicinal systems like Ayurveda, Siddha, Unani, Amchi and traditional systems also, herbal plants are used as hepatoprotective agents and are prosperously tested for their therapeutic ability. Scientists and pharmaceutical industries consider the hepatoprotective potential of the different plants to curb the liver disorders. Therefore, an attempt has been made in this review work to emphasize on the part of the plant and solvent used and the important parameters studied to illuminate the hepatoprotective potential of the innumerous medicinal plants used in curbing different liver toxicities.

Family	Name of Plant	Part Used	Solvent	Parameters used	Reference
Acanthaceae	*Thunbergla laurifolia* Linn.	Leaf	Ethanol	ALT, AST, TGLY, ALP, SBLN, HS, MTT	49
	Hygrophila auriculata Schumach	Seed	Pet. Ether, Methanol	SGOT, SGPT, ALP, SD, GD, SBLN, HS	63
Amaranthaceae	*Amaranthus caudatus* Linn.	Whole plant	Methanol	ALT, AST, SA, SBLN	10
	Amaranthus spinosus L.	Whole plant	Pet. Ether	AST, ALT, ALP, SBLN, MDA, GSH, SOD, CAT, HS	73
	Aerva lanata luss. Ex Schult	Whole plant	Hydroalcoholic	AST, ALT, ALP, SBLN	38
Apiaceae	*Apium graveolens* L.	Seed	Pet. Ether, Acetone, Methanol	SGOT, SGPT, ALP, TP, TA	63
Asclepiadaceae	*Calotropis procera*	Flower	Hydroethanol	SGPT, SGOT, ALP, SBLN, CTLS, HDL, GSH	65
	Decalepis hamiltonii wight. And Arn.	Root	Water	LP, PC, SOD, CAT, GPX, GR, LG, HS	64
	Tylophora indica (Burm.f.)	Leaf	Water	AST, ALT, ALP, TB, LDH, GR, SOD, CAT, GPX, GST, LP, HS	23
Asparagaceae	*Asperagus racemosus*	Root	Water	SGPT, SGOT, ALP, TB, CAT, SOD,	21
	Asparagus racemosus Willd.	Root	Ethanol	AST, ALT, ALP, SBLN, SOD, CAT, HS	34
	Asparagus racemosus Willd.	Whole plant	Crude extract and aqueous fraction	LP, PO, TBARS	71
Asteraceae	*Chamomile capitula*	Capitula	Hydro-ethanolic	LG, NKA, TBARS, ALP, AST, ALT, TP, SBLN, GL	24
	Artemisia absinthium Linn.	Aerial part	Aqueous	AST, ALT, SOD, GPX, MDA, HS, TNF-α, IL-1	8
	Epaltes divaricata (L.) Cass.	Whole plant	Aqueous	ALT, AST, ALP, LG, HS,	27
Apocyanaceae	*Carissa carindas* Linn.	Root	Ethanol	SGOT, SGPT, SALP, GSH, SOD, CAT, LPO	29

	Nerium indicum Mill.	Flower	Methanolic extract	AST, ALT, ALP, SBLN, SOD, MDA, HS.	59
Bignoniaceae	*Kigelia africana* (Lam.) Benth.	Leaf	Aqueous	AST, ALT, TBARS, SOD, CAT, GPX, DAD	44
Bixaceae	*Bixa orellana* L.	Whole plant	Methanolic extract	SGPT, SGOT, CLT, TG, HS	4
Capparidaceae	*Capparis spinosa* Linn.	Root	Ethanolic	AST, ALT, HS	2
Casuarinaceae	*Casuarina equisetifolia* L.	Whole plant	Methanolic extract	SGPT, SGOT, CLT, TG, HS	4
Coclospermaceae	*Cochlospermum planchoni* Hook.f.	Rhizomes	Aqueous	SBLN, ALP, ALT	6
Cucurbitaceae	*Cucumis trigonus* Roxb.	Fruit	Pet. Ether, Chloroform, Alcohol	AST, ALT, ALP, TB	32
	Momordica dioica Roxb.	Ex Willd. Leaf	Ethanolic and aqueous	AST, ALT, ALP, SBLN, HS	28
	Trichosanthes cucumerina L.	Whole plant	Methanol	AST, ALT, ALP, SBLN, TP, TA, LG, MDA, HS	61
Clusiaceae	*Garcinia indica*	Fruit rind	Aqueous	AST, ALT, ALP, TP, SA, STGLY	68
Dryopteridaceae	*Arachniodes exilis* (Hance) Ching	Rhizomes	Ethanol	SGOT, SGPT, MDA, SOD, LP	74
Euphorbiaceae	*Baliospermum montanum* Blume	Root	Alcohol, chloroform	SGPT, SGOT, ALP, HS	69
	Mallotus japonicas (L.f.) Mull.	Cortex	Aqueous	AST, ALT, SD, GST, GR, GGT, MDA	36
	Phyllanthus niruri L.	Leaf, Fruit	Methanol and aqueous	LP, SGOT, SGPT	25
Fabaceae	*Clitoria ternatea* Linn.	Flower	Methanol	AST, ALT, GSH, Bil	30
	Cajanus cajan (L.) Millsp.	Whole plant	Methanol	SGPT, SGOT, AST, ALT, CLT, TG, HS	44
	Cajanus cajan Linn.	Aerial parts	Ethanol	AST, ALT, TP	56
	Tephrosia purpurea (Linn.) Pers	Aerial parts	Aqueous ethanolic extract	AST, ALT, SBLN, ALP, LG, GGT, MDA, HS	33
	Cassia fistula L.	Leaf	N-heptane	SGOT, SGPT, SBLN, ALP	11
	Cassia fistula L.	Seeds	Methanol	SGOT, SGPT, ALP, SBLN	15
	Acacia confusa Merr.	Bark	Hydroalcoholic	AST, ALT, MDA, CP450, SOD, GPX, HS	67
Gentianaceae	*Gentiana olivieri* Griseb.	Aerial part	Ethanol	MDA, LG, AST, ALT	45
	Halenia elliptica D. Don	Whole plant	Methanol	AST, ALT, ALP, SBLN, HS	26
Juncaceae	*Juncus subulatus* Forssk.	Tuber	Hydromethanolic	AST, ALT, ALP, TP, TA, TGLY, MDA	1
Lamiaceae	*Anisochilus carnosus*	Whole plant	Ethanol	SGOT, SGPT, ALP	55
	Hyptis suaveolens Linn.	Leaf	Distilled water	AST, ALT, CAT, Glb, Alb, TP	13
	Leucas ciliata Linn.	Leaf	Ethanol	DPPH, NO, SGPT, SGOT, ALP, BLN, Iron chelation, Reducing power O	42
	Orthosiphon stamineus Benth	Leaf	Methanol extract	AST, ALT, ALP, GST	16
	Hoslundia opposite Vahl	Stem	Methanol, ethyl acetate	AST, ALT, ALP, SBLN	5
	Ocimum sanctum Linn.	Leaf	Hydroalcoholic	AST, ALT, ALP, SBLN, HS	17
Liliaceae	*Aloe barbadensis* Mill.	Aerial parts	Pet. Ether, Chloroform, Methanol	SGOT, SGPT, ALP, SBLN, TGLY, LP, LG, G6P, MAH,HS	18
Malvaceae	*Hibiscus esculentus* Linn.	Root	Ethanol	SGPT, SGOT, ALP, SBLN, LP	57
	Hibiscus sabdariffa Linn.	Calyx	Aqueous	AST, ALT, TBARS, SOD, CAT, GPX, DA	44
Meliaceae	*Azadirachta indica* A. Juss.	Leaf	Hydromethanolic	GPX, GST, SOD, CAT	19
Moraceae	*Ficus religiosa* Linn.	Stem bark	Pet. Ether, Ethyl acetate, Methanol, Aqueous	ALP, TB, SGOT, SGPT, HS	35
	Ficus carica Linn.	Leaf	Ethanol	SGOT, SGPT, TB, ALP, TP, TA	39
Myrsinaceae	*Embelia ribes Burm*.f.	Fruit	Aqueous	SGPT, SGOT, ALP, SBLN, HS	66
Myrtaceae	*Myrtus communis* Linn.	Flower	Water, Dichloromethane	AST, ALT, ALP, LDH.	9
Nelumbonaceae	*Nelumbo nucifera* Gaertn.	Leaf	Ethanolic	ALT, AST, ALP, GGT, SBLN, SOD, CAT, TBARS, LG	12
Nyctaginaceae	*Boerhaavia diffusa* Linn.	Root	Aqueous	GOT, GPT, ACP, ALP, GD, SBLN	54
Piperaceae	*Piper chaba* Hunter	Fruit	Hydroacetone	AST, ALT, MTT, TNF-α	40
	Piper longum Linn.	Fruits and Roots	Milk extract	SGOT, SGPT, ALP, SBLN	47
Pittosporaceae	*Pittosporum neelgherrense* Wt. And Arn.	Stem bark	Methanol	AST, ALT, MDA, SOD, GSH, HS	58
Ranunculaceae	*Nigella sativa* Linn.	Seeds	Aqueous ethanolic	GSH, ALT, AST	20
Rubiaceae	*Morinda citrifolia* Linn.	Fermented fruit juice	Water	Sap, TTP, Str, HS, Flav, Card Gly, Stptztcn.	62
	Rubia cordifolia L.	Roots	Aqueous extract	SGOT, SGPT, GGT, ALP, HS	51
Rutaceae	*Aegle marmelos* (L.) Corr.	Fruit pulp/seeds	Aqueous extract	AST, ALT, ALP, SBLN, HS	60
	Glycosmis pentaphylla Retz.	Whole plant	Methonol	SGPT, SGOT, AST, ALT, CLT, TG, HS	44
	Zanthoxylum armatum DC.	Bark	Ethanol	SGOT, SGPT, ALP, SBLN, TP, SOD, CAT, LG	52
Salvadoraceae	*Azima tetracantha* Lam.	Leaf	Ethanol	SGOT, SGPT, SBLN, TP, ALP, TP, TA, CLT, HS	7
Saururaceae	*Saururus chinensis* (Lour.) Bail.	Whole plant	Ethanol	AST, ALT, MDA, SOD, TC, TGLY, CLT, TA, CE, HS	72
Solanaceae	Solanum nigrum	Whole plant	Water, methanol	AST, ALT, ALP, SB, PCV, RBC, MCV, MCHC PCV, RBC, MCV, MCHC	53
Scrophulariaceae	*Scoparia dulcis* L.	Whole plant	Methanol, Diethyl ether, Pet.Ether	AST, ALT, ALP, TP, GLY, GR LP, SOD, GR, SBLN, HS	48
	Picrorrhiza kurroa Royle ex Benth	Underground stem	Aqueous	AST, ALT, LL, CLT, TGLY	37
Sterculiaceae	*Ptrospermum acerifolium* Linn.	Leaf	Ethanol	SBLN, TP, SGOT, SGPT, ALP	31

Umbellifereae	*Bupleurum kaoi* Liu	Roots	Ethanol	AST, ALT, MDA, SOD, GPX	70
Verbenaceae	*Gmelina asiatica*	Leaf	Chloroform, Ethanol	AST, ALT, ALP, TB M	43
	Clerodendrum inerme (L.) Gaertn.	Leaf	Ethanol	AST, ALT, ALP, TGLY, CLT	22
	Vitex trifolia L.	Leaf	Ethanol, aqueous	SBLN, TP, ALT, AST, ALP, HS	41
Vitaceae	*Vitis vinifera* Linn.	Leaf	Ethanol, Chloroform, n-butanol, water	MDA, AST, LT, GSH, HS	46

SGOT- Serum Glutamyl Oxaloacetic acid Transaminase; SGPT- Serum Glutamyl Pyruvate Transaminase; SBLN- Serum Billirubin; GST- Glutathione-S-Transferase; HS- Histopathological Studies; GPX- Glutathione Peroxidase; ALP- Alkaline Phosphatase; PC- Protein Carbonylation; SD- Sorbitol Dehydrogenase; LP- Lipid Peroxidation; GD- Glutathione Dehydrogenase; SOD- Superoxide Dismutase; CAT- Catalase; AST- Aspartate Aminotransferase; ALT- Alanine Aminotransferase; LG- Liver Glutathione; TP- Total Protein; TA- Total Albumin; MDA- Malondialdehyde; DAD- d-Aminolevulinate Dehydratase; CLT- Cholesterol; TGLY- Triglycerides; GGT-α-Glutamyl Transferase; TBARS- Thiobarbaturic Reacting Substrate; MTT assay- MTT; GR- Glutathione Reductase; NKA- Na^+ K^+ – ATPase activity; GL- Glucogen Level; TG- Total Glucose; PO- Protein Oxidation; MAH- Microsomal Aniline Hydroxylase; G6P- Glucose-6-Phosphatase; AND- Amidopyrine N-demethylase; CP450- Cytochrome P450; TNF- α- Tumor Necrosis Factor alpha; LL- Lipoprotein Level; CE- Collagen Estimation. TB- Total Bilirubin; PCV- Packed Cell Volume; RBC- Red Blood Cell count; MCV- Mean Corpuscular Volume; MCHC- Mean Corpuscular Haemoglobin Concentration; LDH- Lactate Dehydrogenase; SA- Serum Albumin; CTL- Cholesterol; LPO- Lipid Peroxidase; STGLY- Serum Triglycerides; Glb- Globulin; Alb- Albumin; BLN- Bilirubin; Sap- Saponins; TTP- Triterpenes; STR- Steroids; Fla- Flavonoids; Card. Gly- Cardiac Glycosides; Stptztcn- Streptozotocin,

II. CONCLUSION:

For the overall well being of an individual, the maintenance of a healthy liver is essential. The detailed chemical diaganosis has authenticated hepatoprotective activity of plant based traditional and alternative medicines and has lead the pharmaceutical industries to devise more hepatoprotective drugs. A well governed research policy to mark the benefits of hepatoprotective herbal medicine with regard to their safety and efficiency will give better yield of this complementary system of medicine. From this review study it is evident that various herbal plants and their extracts have shown a significant hepatoprotective activity in animal models and these may be used for the future trials.

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