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A REVIEW OF SIDDHA TRADITIONAL SYSTEM PRODUCTS AND THEIR INGREDIENTS IN LIVERDISEASES

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ABSTRACT

Liver is the most important metabolic organ primarily concerned with the biochemical activities in the human body. Liver disease is the tenth most common cause of death in India as per the World Health Organization and may affect one in five Indians. Liver disorders can result from a wide variety of causes, including infections, drugs, toxins, ischemia, and autoimmune disorders. Siddha System of Medicine has been treating various types of disorders since centuries. Siddha system has several indigenous preparations which comprises of minerals, herbs and polyherbal to treat liver injury. Various Siddha formulations and plant drugs prescribed for liver diseases are claimed to have hepato protective activity that need documentation and scientific evidence. This review article provides laborate information on the ingredients – minerals, metals and medicinal plants - and formulations documented in the classical Siddha literature for the treatment of variety of liver disorders. An attempt has been made to provide details on validation of certain Siddha formulations and information about phytoconstituents and pharmacological actions of herbal ingredients. This review article will help the clinicians, professionals, and researchers working the field of traditional system of medicine having interest in liver disorders.

Keywords- *Liver, Siddha system of medicine, Kalleeral Noi, Hepatoprotective,*

INTRODUCTION

Chronic liver disease occurs throughout the world irrespective of age, sex, region or race. According to World Health Organization, about 46% of global diseases and 59% of mortality is because of chronic diseases and almost 35 million people in the world die because of it.[1]Liver diseases are recognized as the second leading cause of mortality amongst all digestive diseases [2]. The major liver diseases that are responsible for most morbidity and mortality are viral hepatitis (hepatitis B and C), alcoholic liver disease (ALD), non-alcoholic fatty liver disease (FLD), cirrhosis and hepatocellular cancer[3,4]. According to the latest WHO data published in 2017 Liver Disease Deaths in India reached 259,749 or 2.95% of total deaths. The age adjusted Death Rate is 22.93 per 100,000 persons, ranking India at #63 in the world[5].

The *Siddha* system of medicine, originated in South India, is one of the oldest traditional systems of medicine that promotes a combination of ancient practices and spiritual disciplines and extensively relies on alchemy.

Liver concept in the *Siddha* system of medicine [6]

In Siddha system liver is considered an important organ actively involved in metabolic functions. Liver is the seat of *Pitta*. When *pitham*- secretion of bile gets affected with other humors it results in different types of liver diseases. The affected *pitham* causes infection in the first two physical constituents, *Udal Thathukal* namely *saram* -nursing juice and *Kuruthi*- blood. This leads to depletion of body tissues and obstruction to the natural pathway of *pithuneer,* bile. Aggravated *pitta* causes liver diseases such as fatty liver, cirrhosis, and hepatitis.

Liver disease / Kalleeral Noi[6,7]

In Siddha liver diseases are called *Kalleeral Noi.* Liver disease is defined as either increase or decrease in the size of the liver and alteration in the normal physiological functions leading to various diseases**.** The other terminologies include *Valapaateeralnoi, Valapateeralviruthi, Kaleeralvalarchi, Maandhakatti, Kalmaandham, Yahrutham.*

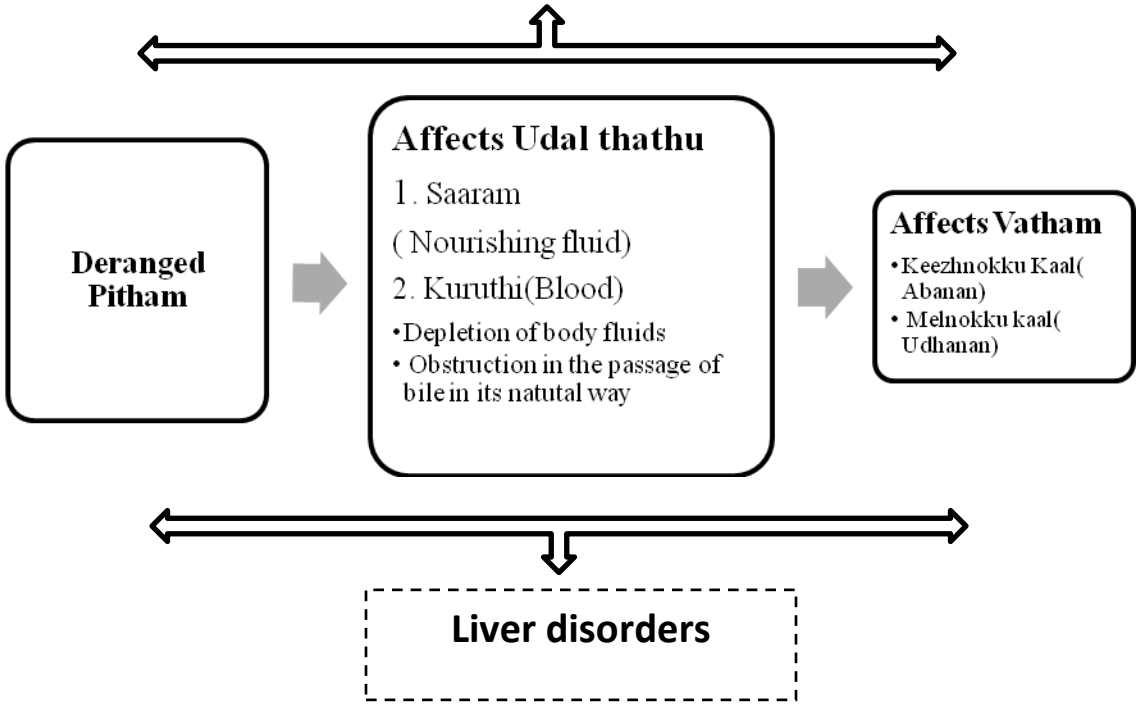
Pathology

Intake of toxic foods, junk foods, alcohol,

Sexually transmitted diseases, Fever

Lifestyle, Environmental causes,

Genetic reasons



Only few papers are available on therapeutic principles of liver diseases in Siddha system of medicine. Papers published by Pratibha et al [2014] and Ponniahsamy G et al. [2015] emphasize the role of 15 herbal plants as hepatoprotective [8, 9]. Formulations like *Chara Parpam,* and novel Siddha formulation *Santha Santhrodhaya Mathirai* have been evaluated for hepatoprotective activity [10, 11, 12].Therapeutic principles of liver diseases in Siddha system of medicine have earlier been published by National Health Portal of Government of India [2011].

METHODOLOGY

The present review paper is based on the literature search undertaken for product and medicinal plant drugs described in Siddha system of medicine. The Formulary of Siddha medicine, Essential drug list published by Ministry of AYUSH and Siddha Medicine

[General] were referred for enlisting all formulations prescribed for liver disorders. They were compiled for composition and each plant drug was further reviewed for phytochemical and pharmacological properties. The research papers and review articles for same were searched through Google and Pub Med searches. The MESH terms used included the following keywords: medicinal plants, formulations, Individual plant drug, liver diseases, Hepatoprotective, hepatic disorders.

Briefly, this review summarises the information about hepatoprotective formulations and herbal drugs used in Siddha traditional medicine for the treatment of liver diseases.

OBSERVATIONAS AND DISCUSSION

After going through classical text and other literature, it is observed that Liver and Spleen are directly or indirectly involved in the following disease

Table 1 List of various liver disorders described in Siddha System of Medicine and its modern counterpart [13]

Siddha terms	**Modern terms**
Veḷuppu Nōy	Anemia
Sobai	Oedema, dropsy
Kaamaalai / Mañcaḷ Nōy	Jaundice
Kalleeral Noi	Liver disease
Maṇṇīral Nōy	Spleen disease
Peruvayiru	Ascites
Pithappaikal	Cholelithiasis
Pitta Vippuruti	Carbuncle /Abscess due to pitham
Pediatric liver diseases	

Classical Siddha Liver Formulations

A number of classical and significant formulations in various dosage forms are mentioned in the Siddha classics for liver diseases. Thirty-two types ofinternalmedicinesand32 types of external medicines in different modes of application are accounted for liver disorders that are even practiced today. Various dosage forms used for liver disorders are as follows.

Chooranam- Fine dry powder

Chendhuram- red oxide form

Karparam- medicaments elixir

Kashayam- decoction

Kudineer - course powder used for decoction

Legiyam– linctus (confectionary)

Manappaagu- flavoured medicinal syrup

Mathirai- traditional tablets

Mezhugu, Kuzhambu, Kalimbu, Mai- Semisolid consistency

Parpam -white calcinated powder

Thylam- oil

Vadagam- traditional tablet

Seventy-eight compound formulations are described to be used in liver disorders. The composition, the method of preparation, the mode of action, the therapeutic indications and the doses of each formulation are provided in detail. (Table 2).

Table 2 - Classical Siddha Formulations for treatment of various chronic liver diseases

[14,15]

Sr. no.	Name of the formulation	Anaemia	Ascites	Hepatitis	Jaundice	Liver diseases	Hepato-splenomegaly
1.	*Aarumuga Chendooram*	√					
2.	*Amukkara Choornam*	√					
3.	*Annabedhi Chendhooram*	√					
4.	*Arithirathi Chooranam*						
5.	*Ashtagunma Lehyam*						√
6.	*Aya Birunga Raasa Karpam*	√					
7.	*Ayajambeera Karpam*	√			√		
8.	*Ayakantha Chendooram*	√	√				
9.	*Chara Parpam*					√	
10.	*Injivadakam*					√	√
11.	*Jala Manjari*	√					
12.	*Kadukkai Choornam*				√		
13.	*Kadukkai Maathirai*	√					
14.	*Kaantha Chendooram*	√					√
15.	*Karisalai Karpam*	√				√	√
16.	*Karuncheeraga Choorna*				√		
17.	*Kodipavala Chunnam*			√			
18.	*Kummatti Mezhugu*	√	√				√
19.	*Maathulai Manappaagu*	√					
20.	*Maha Elathy Kuliga*	√			√		
21.	*Mandoora Chendhuram*	√			√		
22.	*Mandoorathiadai Kudineer*	√	√		√		
23.	*Mukkarattai Choornam*				√		
24.	*Naayurivisamoola Choornam*	√			√		
25.	*Naga Chendhuram*		√				
26.	*Nandhi Mezhugu*	√	√				
27.	*Nava Uppu Mezhugu*		√				
28.	*Nerinchil Kundineer*		√				
29.	*Nilavagai Choornam*			√			
30.	*Panchamirtha Chendooram*	√					

31.	*Pidangunari Kudineer*						√
32.	*Pirandai Vadagam*		√				
33.	*Poorana Chandirodayam*				√		
34.	*Sambiranipathangam*					√	
35.	*Sanjeevitheeneer*				√		
36.	*Sankadravagam*		√				√
37.	*Seenakara Parpam*	√					
38.	*Seenthil Chooranam*	√					
39.	*Suyamakkini Chendhuram*		√				
40.	*Thanga Chendhuram*		√				
41.	*Uppu Choornam*			√			
42.	*Uloka Mandooram*	√	√	√			√
43.	*Vajravalli Choornam*			√			
44.	*Van Mezhugu*		√		√		
45.	*Vediannabedhi Chendhooram*	√					
46.	*Vediannabedhi Chendhooram*	√					
47.	*Velli Chendhuram*	√	√		√		
48.	*Venpoosanillagam*				√		
49.	*Vittunu Chakkaram*			√		√	
External medicines							
50.	*Sarakondraipulipatru Paste*		√				
51.	*Keezhanellithylam*				√		

Paediatric Liver Diseases *[16]*		
52.	*Athimadhura Karkam*	*Manjalkaamalai* [yellowish discoloration of tongue, conjunctiva, nail and urine]
53.	*Ayachendhuram*	*Vathakaamalai* [Due to Vatha]
54.	*Chittramuttivaer Kashayam*	*Thondhakaamalai* [yellowish urine, paleness of conjunctiva]
55.	*Kaanthachendhuram*	*Vathakaamalai* [Due to Vatha]
56.	*Kaantha Parpam*	*Varalkaamalai* [greenish discoloration, dark urine, white colored stool]
57.	*Kaattaamanakkukarka*	*Manjalkaamalai* [yellowish discoloration]
58.	*Karisalai Kashayam*	*Manjalkaamalai* [yellowish discoloration], *Maanthakaamalai*
59.	*KeezhanelliKarkam*	*Manjalkaamalai* [yellowish discoloration]
60.	*Kitta Chendhuram*	*Vathakaamalai* [Due to Vatha]
61.	*Kitta Karkam*	*Varalkaamalai* [greenish discoloration, dark urine, white colored stool,]

62.	*Kizhanelli Kudineer*	*Manjalkaamalai* [yellowish discoloration of tongue, conjunctiva, nail and urine] , *Varalkamaalai* [greenish discoloration, dark urine, white colored stool]
63.	*Kuppaimeni Kashayam*	*Pithakaamalai* [Due to Pitha]
64.	*Maanthakaamalainei*	*Maanthakaamalai* [with Ascites, oedema]
65.	*Manithakkali Karkam*	*Varalkaamalai* [greenish discoloration, dark urine, white colored stool]
66.	*Mudakkarothan Kudineer*	*Oothukaamalai* [oedema in legs, hands and face]
67.	*Mutchangan Maathirai*	*Manjalkaamalai* [yellowish discoloration of tongue, conjunctiva, nail and urine]
68.	*Nannari Kashayam*	*Varalkaamalai* [greenish discoloration, dark urine, white coloredstool]
69.	*Neerkamalai Kashayam*	*Oothukaamalai* [oedema in legs, hands and face]
70.	*Neerkamalainei*	*Oothukaamalai* [oedema in legs, hands and face]
71.	*Nelliparuppu Kashayam*	*Varalkaamalai* [greenish discoloration, dark urine, white colored stool]
72.	*Paruthipaalnei*	*Manjalkaamalai*[yellowish discoloration of tongue, conjunctiva, nail and urine]
73.	*Sangupushpamvaer Karkam*	*Thondhakaamalai* [yellowish urine, paleness of conjunctiva]
74.	*Seeraga Karkam*	*Thondhakaamalai* [yellowish urine, paleness of conjunctiva]
75.	*Thazhuthaazhaivaer Kashayam*	*Paandukaamalai* [Anaemia, Jaundice]
76.	*Thiripalthi Kashayam*	*Oothukaamalai* [oedema in legs, hands and face]
77.	*Thumbai Karkam*	*Pithakaamalai* [Due to *Pitha*]
78.	*Vathakaamalai Kudineer*	*Vathakaamalai* [Due to *Vatha*]

It is observed that some of the formulations are broad-based being used in variety of liver disorders whereas others are specific to a liver disease. The ingredients are also for general or specific use in different liver diseases. These all are aimed towards normalizing the functions of *pittam* and repairing the affected *udalthathukkal* namely *Saaram (*Nourishing fluid) and Kuruthi (Blood).

Most commonly used plant drugs in various Liver diseases

Siddha Materia Medica published by Directorate of Indian Medicine and Homoeopathy, Chennai and essential drug list of Siddha medicine include 21 plant drugs as being extensively used by Siddha practitioners to treat liver disorders. A careful review of these plants, parts/s used, their Siddha properties and details of phytoconstituents with

pharmacological activities obtained through Google and PubMed searches are provided in following table. (Table 3)

Table 3 List of Medicinal plants used for various Liver diseases [17]and its phytoconstituents and pharmacological activity

No	Botanical name/ Tamil name/ Parts used	Taste, Property	Phytoconstituents	Pharmacological Models	Activity
1.	***Aegle marmelos*(L.)** *Vilvam* Leaf, flower, unripe fruit, fruit, root, gum, bark, root bark	astringent, mild bitter taste	alkaloids, Phenylpropanoids, terpenoids	Staphylococcus aureus Intoxicated Albino Rats	Hepatoprotective Study[18]
2.	***Allium sativum*L.** *Vellulli* Bulb	pungent taste, hot property	alliin, allicin, allyl sulfide, (E)-ajoene, (Z)-ajoene and 1,2-vinyldithiin	thioacetamide-induced hepatotoxicity in albino Wistar rats	Hepatoprotective [19]
3.	***Aloe barbedensis miller*** *Katrazhai* Latex, gel, juice and root	mild bitter taste,hot property	alkaloids, tannins, flavonoids, saponins, glycosides, proteins, Amino acid, Steroids	ALD in a chronic alcohol feeding mice	up-regulated hepatic expression of lipolytic genes (AMPK-α2 and PPAR-α) [20]
4.	***Andrographis paniculata*(Burm. f.) Wall. ex Nees** *Nilavembu* Leaves, stem	pungent taste , hot property	andrographolide, panaculoside, flavonoids, andrographonin, panicalin, neoandrographolide, apigenin 7-4-dimethyl ether,	paracetamol induced hepatotoxicity in Swiss albino mice	Hepatoprotective Increased biliary flow [21]
5.	***Azadirachta indica*A. Juss** *Vembu* Leaf, bark	bitter, pungent taste, cold property	nimbidin, nimbin, nimbinin, nimbidinin, nimbolide, nimbidic acid, azadiractin, diterpenoids, margolone.	paracetomol induced hepatotoxicity in rats , antitubercular drugs-induced	Hepatoprotective prevents and reverses the hepatotoxic damage [22]

				hepatotoxicity	
6.	***Boerrhavia diffusa* L.** *Mookirattai* Whole plant	Bitter taste, hot property	b-Sitosterol, a-2-sitosterol, palmitic acid, ester of b-sitosterol, tetracosanoic, hexacosonoic, stearic, arachidic acid, urosilic acid, Hentriacontane, b-Ecdysone, triacontanol	carbon tetrachloride induced hepatotoxicity in albino rats	Hepatoprotective[23]
7.	***Cuminum cyminum* L.** *Seeragam* Seed	Pungent taste, hot property	α-pinene, limonene, 1,8-cineole, linalool , α-terpineole	nimesulide intoxicated albino rats	Hepatoprotective [24]
8.	***Curcuma longa*L.** *Manjal* Root tuber	pungent, bittertaste, hot property	curcumin, Alpha Curcumene,Curcumol, DehydroCurdioneZingiberene	thioacetamide-induced hepatotoxicity in albino Wistar rats	Hepatoprotective activity [25]
9.	***Eclipta alba*(L.) Hassk./ *Eclipta prostrata* Roxb** *Karisalankanni* Whole plant	Bitter taste, hot property	coumestans, alkaloids, flavonoids, glycosides, polyacetylenes, triterpenoids, stigmasterol, β-terthienylmethanol, wedelolactone	carbon tetrachloride induced hepatotoxicity in albino rats	Hepatoprotective [26]
10.	**Emblica officinalis Gaertn or *Phyllanthus emblica* Linn** *Nelli* Leaf, flower, bark, root, fruit, seed	sour, astringent, sweet taste, cold property	gallic acid, ellagic acid, chebulinic acid, quercetin, chebulagic acid, phyllantine, Phyllantidine, punigluconin, Pedunculagin, Emblicani Emblicanin-B.	Paracetamol and CCl4 induced hepatotoxicity	Prevents/ameliorates the toxic effects of hepatotoxic agents[27]
11.	***Erythrina indica***	Pungent taste,	erythrina	Anti-tubercular	Hepatoprotective

	Linn. *Kalyanamurungai* Leaf, flower, seeds, bark	hot property	alkaloids, Alkaloids, flavonoids, pterocarpans, triterpenes, steroids, alkyl trans-ferulates, proteins, and lecithin	drugs induced hepatotoxicity in rats	[28]
12.	***Glycyrhiza glabra* L.** *Adhimathuram* Root bark	Sweet taste, cold property	liquirtin, isoliquertinliquiritigenin and rhamnoliquirilin, glucoliquiritinapioside, prenyllicoflavone A, shinflavanone, shinpterocarpin and 1-methoxyphaseolin, glycyrrhizin	carbon tetrachloride induced hepatotoxicity in albino rats.	Hepatoprotective Anti-oxidant property Anti-lipid peroxidation Effect [29]
13.	***Hemidesmus indicus* (L.) R.Br.** *Nannari* Root	sweet, mild bitter taste, cold property	hexatriacontane, lupeol, its octacosanoate, α-amyrin, β-amyrin, its acetate and sitosterol.	carbon tetrachloride induced hepatotoxicity in albino rats	Hepatoprotective [30]
14.	***Indigofera aspalathoides* DC.** *Avuri* Leaf	pungent, astringent taste, hot property	flavonoids, glycosides, lignin, ialkaloids, steroids, fatty acids containing amino group	carbon tetrachloride induced hepatotoxicity in albino rats	Hepatoprotective [31]
15.	***Phyllanthus amarus* L.** *Kizhanelli* Whole plant	sour, bitter, astringent& sweet taste	coumarin, gallic acid, ellagic acid, ethyl breyifolin, corilagin, carboxylate, flavonoid, quercetin, rutin, astragalin, quercetin, isoquercitrin, phyllanthin, hypophyllanthin, nitranthin, nirtetralin, phyltetralin, hinokinin.	ethanol induced hepatotoxicity in rats	Hepatoprotective[32]
16.	***Picrorhizza kurroa* Royle Ex Benth**	bitter, pungent, taste, hot property	picroside I and II, kutkoside,	carbon tetrachloride induced	Hepatoprotective[33]

	Kadugurohini Root			Hepatotoxicity in albino rats	
17.	***Piper longum* L.** *Thippili* Fruit	Pungent taste, hot property	volatile oil, starch, proteins,alkaloids,saponins, carbohydrates	Anti-tubercular drug induced toxicity in Swiss albino mice	Hepatoprotective[34]
18.	***Solanum nigrum* L.** *Manaththakkali* Leaf, fruit	Sweet taste, cold property	polyphenols, Solanine, Other glyco-alkaloids chaconine and solasodine	carbon tetrachloride induced Hepatotoxicity	Hepatoprotective [35]
19.	***Terminalia chebula* Retz.** *Kadukkai* Unripe fruit and fruit	astringent, mild sweet, sour, pungent and bitter tastes, hot property	tannins, flavonoids, sterols, amino acids, fructose, resin, fixed oils, anthraquinonesethaedioic acid, sennoside, terpinenes, terpinenols	*t*-BHP-Induced Acute Liver Injury in C57/BL6 Mice	Hepatoprotective [36]
20.	***Tinospora codifolia* (Thunb.) Miers** *Seendhil* Stem, leaf, root tuber	bitter taste, cold property	tinosporone, tinosporic acid, cordifolisides A to E, syringen, berberine, giloin, gilenin, crude giloininand, arabinogalactan polysaccharide, picrotene, bergenin, gilosterol, tinosporol, tinosporidine, sitosterol, cordifol, heptacosanol, octacosonal, tinosporide, columbin	carbon tetrachloride induced hepatotoxicity in albino rats mice, rats and rabbits	Hepatoprotective Immune stimulating, Antioxidant, Modulation of Kupffer cell activity [37,38, 39]
21.	***Zingiber officinale* Rosc.** *Inji* Rhizome	Pungent taste, hot property	gingerols, Shogaol, Paradol, gingerdione, zerumbone	carbon tetrachloride induced hepatotoxicity in albino rats	Hepatoprotective [40]

Twenty-one medicinal plant drugs are used in multiple formulations. Repeated use in elevation of liver dysfunctions underlines the importance of their medicinal value. Information on chemical composition and biological effects/s of these plants would be of help in exploring their use in more complex and severe conditions.

DISCUSSION

Siddha and Ayurveda, both are ancient Indian systems of medicine having similar concepts. Siddha medicine authoritatively and predominantly uses herbo-mineral, metallic and mineral compounds that are known to possess longer shelf life, greater efficacy with little dose and potent therapeutic effectiveness.

Siddha system follows various methods for medicinal preparations. Important among them are processes involving drugs based on combined ratio of five elements [*Aeagamooligai prayogam*], processes involving antagonism and synergism – *[Maaranaprayogam*], and processes involving distilled acids *(Dhravagam), Ceyneer* and *Muppu*[41].

Preparation of specific drugs like *Kattu, Urukku, Kalangu* and *Chunnam* which have long shelf life and the medicinal forms like *Chatthu, Gurukuligai* of infinite life span, are accomplished by such ingenious processing methods.

More than 78Siddha formulations, combination of herbs and minerals, are used in liver disorders specifically in anaemia, ascites, jaundice, hepatitis, and enlargement of liver conditions. These products are the combination of herbs and minerals.

Most commonly used formulations are *Parpam* (mineral/metallic oxides) and *Chendhooram* (mineral/metallic sulphides) others being *Churnnam* (caustic or major oxides) and *Pathangam* (sublimation).[42]

Mode of Action of some formulations

Santha Santhrothaya Mathirai (SSM) which majorly comprises of borax, mercurous chloride, turmeric and lemon juice possesses promising hepatoprotective activity against paracetamol and methotrexate induced liver cell line study. [43]

Karisalai Karpam tablet is a siddha formulation containing seven plants, *Karisalankanni [Eclipta alba L.], Avaui [Indigofera tinctoria L], Kottakkaranda [Sphaeranthus indicus L.],*

Vallarai [Centellaasiatica L.], Kuppaimeni [Acalypha indica L.], Siruseruppada [Coldenia procumbens L.]. This is a proprietary medicine used to cure liver disorders such as jaundice, enlargement of liver and spleen, anaemia. It possesses the hepatoprotective property and antioxidant activity against paracetamol-induced liver damage, which provides a support for its use in treatment of liver disorders.[44]

Chara Parpam at the dose 10 mg/kg possesses significant hepatoprotective property in CCL4 induced liver toxicity in rat model. This study indicated the dose-effect relationship of Chara Parpam. [45]

TSF is a combination of seven botanicals includes *Sphagneticola calendulacea whole plant, Phyllanthus amarus whole plant, Terminalia chebula pericarp, Terminalia belerica fruit, Emblica officinalis fruit, Curcuma longa rhizome and Cuminum cyminum fruit*. Research suggested that TSF Significantly inhibited CCl4 induced hepatic fibrosis; this anti-fibrotic activity may be associated to the spectrum of synergistically active phytochemicals. [46]

Aruvadha Churnam, a commonly used Siddha formulation in management of hepatic ailments was validated for its hepatoprotective effect against Paracetamol induced hepatic damage [47]. *PithaKamalai Choornam* produces antioxidant activity suggesting that the *PithaKamalai Choornam* may be useful to prevent oxidative stress induced damage in liver. [48]

Kadukkaimaathirai (KM) is a polyherbal formulation used for the treatment of liver diseases and iron deficiency anaemia provided dose dependent hepatoprotective activity of KM against CCl_4 induced liver injury. The Siddha metallic mineral formulation *Vediannabethi Chenduram, Pungampoo chooranam* and *Arithirathi Chooranam* were screened for their hepato protective activity. [49, 50,51]

Medicinal plant drugs used in various formulations of liver diseases are having anti-viral, hepatoprotective, anti-hepatotoxic, anti-cholestasis, anti-microbial, antioxidant, anti-inflammatory, immunomodulatory actions. Combination of various drugs in the herbo-mineral, mineral or herbal formulations are having hepatoprotective activity and they restore the functional efficiency of the liver by protecting the hepatic parenchyma and promoting hepatocellular regeneration. Most importantly Siddha system indicates

command over use of metallic and herbo-mineral compounds that are otherwise considered toxic in nature.

CONCLUSION

In this review article, an attempt has been made to compile the ingredients and formulations used in Siddha system of medicine to treat different types of liver diseases. Several of these have been scientifically validated for hepatoprotective activity. Use of Siddha preparations in liver diseases provide a challenging opportunity to undertake studies that may prove to be innovative in terms of their effectiveness in certain serious liver conditions and also provide new insights into toxicological aspects of minerals, metals and herbo-mineral compounds. This review provides additional information to strengthen the use of several medicinal plants that are known in Siddha or proven to be pharmacologically hepatoprotective.

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CONFLICT OF INTEREST: No confliction

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