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# *Anal Chooranam* – A Herbo-Mineral formulation in the Management of *Kamalai* (Jaundice)

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**Abstract:** Liver diseases are one of the most fatal diseases worldwide today. It accounts for approximately 2 million deaths per year and its death rate is steadily increasing over the years. Hepatoprotective agents have been given attention due to their therapeutic role in the management of liver disease. The usage of herbal medicines to treat liver diseases has increased worldwide, and this is due to the belief that herbal medicines are harmless and devoid of side effects Moreover, the use of alternative medicine, particularly herbal preparations has expanded because of the limited therapeutic choices and sometimes unsatisfactory therapeutic failure of modern medicine. So, there is a need for a safe, potent, cost-effective hepatoprotective drug to treat liver disease. The Siddha system enlists numerous medicines for liver diseases that are obtained from natural sources (Minerals). *Anal chooranam* is one of the Herbo-mineral formulation indicated for *kamalai* which is mentioned in *Sirorathina vaidhya booshanam*. This drug comprises six ingredients *Cissus quadrangularis* L., *Smilax chinensis* L., *Cuminum cyminum* L., *Tamarindus indica* L., *Euphorbia antiquorum* L., and Sodium chloride. The ingredients of Anal chooranam possess pharmacological activities like hepatoprotective, antioxidant, and anti-inflammatory activities, in various scientific studies. This review article mainly reflects on properties, chemical constituents, pharmacological activities, medicinal uses, and Siddha aspects of the drug *Anal chooranam*. With this regard, this review throws the limelight to carry out further scientific studies to validate the therapeutic claim of this formulation.

**Keywords:** Liver disease, Siddha system, *Anal chooranam*, Pharmacological activities, Hepatoprotective

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## Introduction

The liver is a vital organ that plays an important role in the elimination of xenobiotics from the body. It performs a vital role in the metabolism, secretion, storage, and detoxification of endoge-

nous and exogenous substances. Liver damage is usually associated with the distortion of some of these functions. Liver diseases may be fatally posing a serious challenge to international public health( Ali *et al*., 2009; Wang *et al*., 2014). Diseases that affect the liver have become one of the major health problems among healthcare professionals as well as the pharmaceutical industry. In the modern scenario, diseases are becoming drug-resistant and scientists have proven the possible roles of plant-based drugs for screening life saving drugs. Hepatoprotection or Anti-Hepatotoxicity is defined as the ability to prevent damage to the liver. Even with the development of new hepatoprotective drugs the incidence of hepatic diseases has not decreased and statistics suggest that these continue to increase (Zhao *et al*., 2009; Macias *et al*., 2010; Waring, 2012). Nowadays, the incidence of side effects due to colchicine, interferon, corticosteroids, and penicillamine is profound (Mendez, 2005; Abdallah *et al*., 2013). It is, therefore, necessary to search for alternative drugs for the treatment of liver diseases to replace the currently used drugs of doubtful efficacy and safety (Kumar *et al*., 2013). The World Health Organization (WHO) estimates that 80% of the world's health population presently uses herbal medicines for some aspect of primary health care. The process of healing and regeneration of liver cells is supported and promoted by herbal preparations with fewer side effects (Boullata and Nace, 2000). Various plants have hepatoprotective activities and those are considered a very rich source to treat liver diseases (Kunle *et al*., 2018).

A healthy liver is essential for a healthy life. So, it is important to protect the liver healthily. One of the healthy and natural ways to protect the liver from damage can be achieved by Siddha medicines. Various Herbo-mineral or polyherbal formulations are available to treat liver diseases. Siddha medicines are highly effective and devoid of adverse effects. For this reason, the Siddha system of medicine has been drawing global attention in recent times. Liver disorders are increasing day by day. So, there is a need and demand for effective, safe, and accurate treatment of liver diseases. According to Siddha medical pathology, liver diseases are caused based on the abnormalities seen in the bodily Vital humors *Pitham* and *Kapham*. Siddha formulations were prepared as per the concept of *Arusuvai*. The major sign of liver disease is Jaundice (Hyperbilirubinemia) which is known as the yellowish decolourisation of skin and mucous membranes. In the Siddha system of medicine, 'Jaundice' is correlated with *Pitha Kamalai* or *Manjal Kamalai*. As per Saint Yugi Muni, *Manjal Kamalai* is of 13 types. Out of the 13 types, only seven types are curable (Kuppusamy, 2001). The term *Manjal* means yellow and *Kamalai* (Kamam Illai) means lack of interest. This is because the disease-affected person will lose interest in food, and activities. As per Siddha concept, the etiology of the disease is due to excessive intake of food and activities that aggravate *pitham,* destroying *seneer* (blood), one of the seven *udalthathhukkal* (physical constituents) (Sherwin and Sobenes, 1996). *Anal chooranam* (AC) is a Herbo-mineral formulation, it contains five plants namely *Cissus quadrangularis* L., *Smilax chinensis* L., *Cuminum cyminum* L, *Tamarindus indica* L., *Euphorbia antiquorum* L. *and* Sodium chloride based on the Siddha *Sirorathina vaidhya bhooshanam* (Angamuthu, 2013). The ingredients, purification and it's Siddha concepts are illustrated in Tables 1 and 2.This formulation is used in treating *Sanni* (Apoplexy includes Delirium and tetanus), *kumarakandan* (Contraction of axial and limb muscles), *Kamalai* (Jaundice), and *Pitha sogai* (dropsy). This article aims to focus on the potential role of *Anal chooranam* as a hepatoprotective drug and the Scientific details, which included morphological descriptions, phytochemical constituents, and pharmacological studies collected from different sources, including published report. Further preclinical and clinical studies must be done to prove the therapeutic claim of this formulation.

## *Method of Preparation*:

After the purification process, the raw drugs were

dried, then powdered individually and sieved with white cloth (*Vasthirakayam*). The sieved powders were combined to get the *Chooranam* and stored in a clean and air-tight glass container.

**Drug dosage:** *Thirikadi pramanam* (3 finger breath)

**Adjuvant:** *Sarkkarai* (Sugar) , *Thaen* (Honey)

**Indications:** *Sanni* (Apoplexy includes Delirium and tetanus), *kumarakandan* (Contraction of axial and limb muscles), *Kamalai* (Jaundice), *Pitha sogai* (dropsy).

*The pharmacognostic aspect of Anal chooranam*:

The botanical aspects of herbs found in *Anal chooranam* are mentioned below:

1. **Botanical Name:** *Cissus quadrangularis* L.

   **Tamil name:** Pirandai

   **Synonyms:** *Cissus bifida* Schumach. and Thonn., *Cissus edulis* Dalzell, *Cissus quadrangula* L., *Cissus quadrangula* Salisb.

   **Family:** Vitaceae

Morphological Description: *Cissus quadrangularis* is a tendril-climbing shrub with fleshy quadrangular stems. The plant is widely seen in tropical regions of Asia and Africa (Chopra *et al*., 1975; Mehta *et al*., 2001; Oben *et al*., 2006). The fleshy part of the stem is the major portion. it reaches a height of 1.5 m. Small white, greenish, or yellowish flowers, berries are globular in shape when ripe (Frank *et al*., 1995).

Chemical constituents: Major Phyto constituents present in the plant are flavonoids like quercetin, daidzein and genistein, triterpenoids like friedelin, vitamin C, stilbene derivatives like quadrangularin A, resveratrol and piceatannol, iridoids like 6-0-meta-methoxybenzozyl catapol, picroside and pallidol and phytosterols like βsitosterol and calcium (Prasad and Udupa, 1963; Jainu and Devi, 2006). The stem parts of plant contain A and β-amyrins, βsitosterol, ketositosterol, phenols, 31 methyl tritiacontanoic acid, taraxeryl acetate, taraxeroliso-pentadecanoic acid, Calcium ions and phosphorus ( Panthong *et al*., 2007; Jain *et al*., 2008).

Medicinal uses: Due to its bone ligation properties, the plant is named as *Asthisamharaka* in Sanskrit (Viswanatha Swamy *et al*., 2006). *C. quadrangularis* is used in the treatment of anorexia, diabetes, piles, obesity, chronic ulcers, asthma, otorrhoea, wounds and weak bones (osteoporosis) and as body-building supplements as an alternative to anabolic steroids.

2. **Botanical Name:** *Smilax china* L.

   **Tamil name:** Parangipattai

   **Synonyms:** *Smilax japonica* (Kunth) A. Gray, *Smilax taiheiensis* Hayata, *Smilax pteropus* Miq.

   **Family:** Smilacaceae

Morphological Description: *Smilax chinensis* is a deciduous climber with rounded leaves. It has a large, hard, uneven rhizome blackish externally, Pale coloured internally. This plant is widely distributed worldwide in tropical and temperate regions. Berries are red in colour (Khan *et al*., 2009; Seo *et al*., 2012).

Chemical constituents: Thirteen compounds were identified as kaemperol-7-O-beta-D-glucopyranoside, kaempferol, dihydrokaempferol, engeletin, isoengeletin, dihydrokaempferol-5-O-P-D-glucopyranoside, rutin (Shao *et al*., 2007; Chen *et al*., 2011).

Medicinal uses: The tuber is used for the treatment of furunculosis, inflammation, gout, and tumors (Chen *et al*., 2011). Detoxifies organs, cleanses the blood, and aids absorption. This plant helps to increase urination and protects the liver (Ruan, 2005; Li *et al*., 2007; Shu *et al*., 2006).

3. **Botanical Name:** *Cuminum cyminum* L.

   **Tamil name:** *Seeragam*

   **Synonyms:** *Cuminum odorum* Salisb, *Cuminia cyminum* J.F. Gmel, *Cuminum hispanicum* Bunge, *Ligusticum cuminum* (L.) Crantz

   **Family:** Apiaceae

Morphological Description: Cumin grows to about

Table 1: Ingredients and Purification of *Anal chooranam*

| S. No. | Name of the drug | Scientific name | Quantity | Purification |
|---|---|---|---|---|
| 1 | *Pirandai* | *Cissus quadrangularis* L | 5 palam<br><br>(175 g) | Joints of the well grown stalks are cut at both ends and jointless stalks are collected. Then they are boiled with 2 pints of sour curd mixed with 4 grams of *induppu*(Rock salt), until the entire curd evaporates. Then dried the stem in the shade and powdered as fine powder (Chidambarathanu Pillai, 1992) |
| 2 | *Sathurakallippattai* | *Euphorbia antiquorum* L. | 1 palam (35 g) | Plant part is washed in the running tap water to remove the soil and impurities and dried in shade. (Sarakku Suthi Muraigal, 2008) |
| 3 | *Puliyamppattai* | *Tamarindus indica* L. | 1 palam (35 g) | Plant part is washed in the running tap water to remove the soil and impurities and dried in shade. |
| 4 | *Parangippattai* | *Smilax chinensis* L. | ½ palam (17.5 g) | Dried tuber of Smilax china is steamed using milk, dried well, and powdered (Sorna Maariyammal, 2010) |
| 5 | *Jeerakam* | *Cuminum cyminum* L. | ½ palam (17.5 g) | The drug is cleaned well without any dust and impurities and dried in sunlight. |
| 6 | *Sotruppu* | *Sodium chloride* | 1 palam (35 g) | dissolve in sea water or rain water is filtered and boiled in a clay pot, till it reaches semisolid state. Then it is dried in sunlight till it attains the solid states as purified salt. (Thiyagarajan, 2013) |

30–60 cm tall. Stems are glabrous, branched, and slender in nature. The flowers, small, white, or pink are overtopped by the bracts. The cumin seed is yellow to brownish-grey in color, and has schizocarpic fruits (Piri *et al*., 2019).

Chemical constituents: The cumin seeds contain glycosides (22%), aldehyde (60%), volatile oil (2-5%), fats, amino acids, and flavonoids. The major compounds occurring in cumin are cumin aldehyde, α- and β-pinene, 1, 8-cineole, α- and γ–terpinene, safranal and linalool, limonene, o-and p-cymene. The organic acids in cumin are malic, tartaric, aspartic, citric, propionic, ascorbic, oxalic, gallic acid, cinnamic acid, hydroquinone, coumarin and quercetin (Iacobellis *et al*., 2005; El-Kani *et al*., 2007).

Medicinal uses: Cumin is used as a carminative, astringent, stimulant (Li and Jiang, 2004; Gallo *et al*., 2010) and as well as a remedy against dyspepsia, epilepsy, diarrhea, flatulence, whooping cough, indigestion, and jaundice. It is commonly used as a remedy against gastrointestinal, inflammatory, and neurological disorders, as well as toothaches (Fadel, 1999; Rebey, 2017; Bhatt *et al*., 2017; Kanani *et al*., 2019).

**4. Botanical Name:** *Tamarindus indica* L.,

**Tamil name:** Puliyam Pattai

**Synonyms:** *Tamarindus occidentalis* Gaertn.,

*Tamarindus officinalis* Hook., *Tamarindus umbrosa* Salisb

**Family:** Fabaceae

Morphological Description: *Tamarindus indica* grows about 24 m in height. Leaves alternate, compound, with 10-18 pairs of opposite leaflets; curved or straight. Flowers yellow or pinkish. Fruit is a pod, indehiscent (Rao, 1999).

Chemical constituents: *T. indica* revealed the presence of many active constituents, such as cardiac glycosides, phenolic compounds, tartaric acid, mucilage, pectin, arabinose, and uronic acid (Ibrahim and Abbas, 1995; Coutino-Rodriguez *et al*., 2001). The ethanolic extract of *T. indica* showed the presence of essential elements like cadmium, copper, iron, sodium, arsenic, calcium, manganese, magnesium, potassium, phosphorus, lead, and zinc (Samina *et al*., 2008). The root bark of *T. indica* showed the presence of eicosanoic acid, n-hexacosane, octacosanyl ferulate, b-sitosterol, 21-oxobehenic acid, and (+)-pinitol (Jain *et al*., 2007).

Medicinal uses: The bark of the tamarind tree is used as a tonic & in lotions or poultices to relieve boils, sores, ulcers, and rashes. A decoction is used in cases of gingivitis, asthma, and eye inflammation (Morton, 1987; El Siddig *et al*., 2006).

## 5. Botanical Name: *Euphorbia antiquorum* Linn.

**Tamil name:** Sathurakalli pattai

**Synonyms:** *Euphorbia cactus*, *Euphorbia cervicornis*, *Euphorbia nuvulia*

**Family:** Euphorbiaceae

Morphological Description: It is a succulent plant that reaches up to a height of 8 meters. The older stems are smooth, and slender and have a brownish colour of bark (Kirtikar and Basu, 1935). The odor of latex is pungent and lingering. The blooming season of flowers and fruit is throughout the year (Warrier, 1993).They are full of honey that attracts bees. Fruit is capsules, glabrous, and becomes deep red on maturity year. Fruits are schizocarp, yellowish to orange in color (Deka and Vodhdal, 2008; Kumar *et al*., 2010).

Chemical constituents: *Euphorbia antiquorum* Linn showed the presence of Diterpenes, Triterpenes and Flavonoids Jatrophane, Lathyrane, Tigliane, Ingenane, and Myrsinol. Latex of the plant contains eupha-7, 9(11), 10-alpha-eupha-5, 24-dien-3beta-ol (antiquol B), 24-trien-3beta-ol (antiquol C), 19(10-->9) abeo-8alpha, 9beta, and 24-methyltirucalla-8, 24(24(1))-dien-3beta-ol (euphorbol), lemmaphylla-7, 21-dien-3beta-ol, isohelianol, and camelliol (Anjaneyulu and Ravi, 1989; Akihisa *et al*., 2002; Noemi *et al*., 2004).

Medicinal uses: *Euphorbia antiquorum* Linn is used for inflammation, diabetes, wounds, arthritis, stomach aches, and as a purgative (Gewali *et al*., 1990). Fresh milky juice is used for enlargement of the spleen, snake bite, anti-microbial, aphrodisiac, conjunctivitis, cough, cutaneous infection, deafness, dropsy, emetic, and jaundice (Parveen *et al*., 2010; Wen *et al*., 2012; Benrit *et al*., 2012; Kumar and Saikia, 2016).

## 6. Sodium chloride

**Chemical name:** Sodium chloride
**Chemical formula:** NaCl

**Molecular weight:** 58.44 g/mol **Melting point:** 801 °C

**Solubility:** Water, Ammonia, Ethanol, Methanol, Glycerol, Formic, acid, Formamide, Propylene glycol.

Description: Sodium chloride is a metal halide composed of sodium and chloride. It is an inorganic chloride salt that has been replaced to maintain intracellular osmolarity, nerve conduction, and muscle sodium as the counter ion. It is an inorganic chloride and an inorganic sodium salt. Commercial grade usually contains chlorides of calcium and magnesium which absorb moisture and cause caking. It is 97 % to 99 % sodium chloride, NaCl. Usually, anti-cancer agents such as sodium alumina containing potassium iodide are widely available. Table salt may be white or, may have a faint purple or blue tinge from impurities.

Source: One of the main sources of table salt is the mineral halite or rock salt. Halite is mined. The minerals in mined salt give it a chemical composition and flavour unique to its origin. Another source of table salt is evaporated sea water or sea salt (Essakkypandian, 2019).

Pharmacological activities: Stomachic, emetic, anthelmintic, laxative, febrifuge, anti-ulcer.

Mechanism of action: Sodium and chloride are the major electrolytes present in the extracellular space. These electrolytes work together to control ECF volume and Blood pressure.

Absorption: The absorption of sodium in the small intestine plays a major role in the absorption of chloride, amino acids, glucose, and water. Chloride, in the form of hydrochloric acid (HCl), is also an important component of gastric juice, which helps in digestion and absorption of nutrients.

Protein binding: Sodium is not bound by plasma proteins.

Volume of distribution: The volume of distribution is 0.64 L/kg.

Metabolism: The salt that is taken into the GI tract remains the most unabsorbed as the liquid contents pass through the stomach and small bowel. On reaching the colon, this salt together with the water, is taken into the blood.

Route of elimination: Excreted by the kidney.

Medicinal uses: Sodium chloride is used together with water as one of the primary solutions for intravenous therapy. Nasal spray often contains a saline solution. It is used as a raw material for making many useful chemicals in the industry such as sodium hydroxide, sodium carbonate, baking soda, etc. Oral salt administration includes swollen tongue, abdominal cramps, and thirst.

*Pharmacological Evaluation of Drugs of Anal Chooranam*:

(i) *Cissus quadrangularis* L.

Hepatoprotective activity: Swamy *et al.* (2012) investigated the hepatoprotective activity of methanol extract of *C. quadrangularis* against rifampicin-induced hepatotoxicity in rats. Liver damage was induced in Wistar rats by administering rifampicin (54 mg/kg, p.o) once daily for 30 days. Rifampicin administration significantly increased lipid peroxidation and decreased antioxidant activities like reduced glutathione, superoxide dismutase, and catalase. Pre-treatment of rats with methanol extract of *Cissus quadrangularis* significantly decreased lipid peroxidation and increased antioxidant activities. It was concluded that the mechanism of hepato-protection may be attributed to its antioxidant activity especially the presence of β–carotene (Swamy *et al*., 2012). Swamy *et al*. (2010) investigated the hepatoprotective activity of methanol extract of *Cissus quadrangularis* (CQ) against isoniazid-induced hepatotoxicity in rats. Hepatic damage was induced in Wistar rats by administering isoniazid (54 mg/kg, p.o) once daily for 30 days. Isoniazid administration significantly increased lipid peroxidation (LPO) and decreased antioxidant activities such as reduced glutathione, superoxide dismutase, and catalase. Pre-treatment of rats with CQ significantly decreased LPO and increased antioxidant activities. The results of this study indicated that the hepatoprotective effect of CQ might be attributed to its antioxidant properties (Swamy *et al*., 2010).

Anti-oxidant activity and free radical scavenging activity: Methanol extract of *Cissus quadrangularis* exhibits strong antioxidant and free radical scavenging activity in *in vitro* and *in vivo* systems mainly due to the presence of β-carotene (Austin *et al*., 2004; Pottu *et al*., 2008). Muthusamy *et al.* (2016) studied *C. quadrangularis* for its effect on the antioxidant system of the femur in ovariectomized rats. Results show the extract prevented ovariectomy-induced oxidative stress in the femur (Muthusami *et al*., 2016). Ethanolic extract of *C. quadrangularis* exhibited a significant scavenging effect on DPPH free radical, superoxide radical, hydroxyl radical production, and inhibition of lipid peroxide production in erythrocytes (Jainu and Devi, 2005; Sapsrithong *et al*., 2012).

Analgesic, anti-inflammatory, and stimulatory activity: Methanol and dichloromethane extract of stems possess anti-inflammatory activity against COX-2. The stimulatory effect of the extract is probably due to vitamins and is greater than that of the anabolic hormone durabolin (Frank *et al*., 1995). The anti-inflammatory effect of *C. quadrangularis* is associated with luteolin, and β-sitosterol (Panthong *et al*., 2007; Shadmani *et al*., 2018). Ethyl acetate extract of *C. quadrangularis* potently inhibited lipopolysaccharide-induced nitric oxide production in RAW 264.7 macrophage cells in a dose-dependent manner (Srisook *et al*., 2011). Kanwar et al. (2015) confirmed the anti-inflammatory and cartilage-regenerative properties of *C. quadrangularis* and hydroalcoholic extract of the plant reduced serum TNF-α, oxidative stress, and synovial expression of inflammation.

(ii) *Smilax chinensis* L.

Hepatoprotective activity: The hepatoprotective activity of chloroform, ethyl acetate, and methanol extracts at the dose of 100 mg/kg body were evaluated against paracetamol-induced liver damage in rats. The ethyl acetate extract showed significant hepatoprotective activity and the standard drug Silymarin (25 mg/kg) with respect to all selected hepatic markers. It was observed that the ethyl acetate extract showed the best antioxidant effect among the other two extracts. So, the study concluded that the ethyl acetate fraction produces a hepatoprotective effect by antioxidant mechanism (Mandal *et al*., 2008; Venkidesh *et al*., 2010). Anita Mural et al. (2014) studied the hepatoprotective activity of methanol extract of *Smilax zeylanica* L. leaf against carbon tetrachloride-induced hepatotoxicity in Wistar rats. Hepatotoxicity was induced in Wistar rats by administration of $CCl_4$ (0.5 ml/kg p.o) once a day for 7 days. Hepatic damage is evidenced by the significant elevation in serum levels of total bilirubin, SGOT, SGPT, and ALP, decrease in total proteins and albumin (Anita Mural *et al*., 2014).

Analgesic, anti-inflammatory, and stimulatory activity: The ethyl acetate and methanolic extract of *Smilax chinensis* showed dose-dependent anti-inflammatory activity and reduction in the duration of licking in the late phase in analgesic activity (Raghunadha Reddy *et al*., 2010). The presence of Sieboldogenin in *Smilax chinensis* shows significant lipoxygenase inhibition ($IC_{50}$: 38 μM). Computational molecular docking shows the molecular interaction with essential amino acid residues in the catalytic site of lipoxygenase, revealing its potential binding form at the molecular level (Inamullah Khan *et al*., 2009).

Anti-oxidant activity and free radical scavenging activity: Lee *et al*. (2001) investigated the possible presence of antioxidant activity of *Smilax chinensis* root extract. V79-4 cells treated with Smilax chinensis root induced an increase of catalase, superoxide dismutase, and glutathione peroxidase activities in a dose-dependent manner between 4-100 μg/ml (Lee *et al*., 2001). The ethyl acetate fraction of *Smilax chinensis* showed the highest antioxidant properties, correlating with the high phenolic levels, particularly catechin and epicatechin (Yamini *et al*., 2001; Jeong *et al*., 2011). Ethanolic extract of *Smilax chinensis* rhizomes at 100 and 200 mg/kg b.wt. showed significant testicular free radical scavenging activity and restoration to normal spermatological parameters (Saraswathi and Sreemantula, 2012).

(iii) *Cuminum cyminum*

Hepatoprotective activity: Hepatotoxicity was induced by oral administration of 100 mg/Kg Nimesulide suspension. The results were compared with Silymarin (25 mg/kg, P.O.) treated animals. The cumin seed extract significantly ($p< 0.001$) reduced the serum enzyme in comparison to the intoxicated control group (Aamir Mushtaq *et al*., 2014). Cumin seeds contain monoterpenes, sesquiterpenes, aromatic aldehydes, terpene esters in a small fraction (Faure *et al*., 1990; Tran *et al*., 2001; Yan *et al*., 2002). Administration of *Cuminum cyminum*, *Phyllanthus emblicus* extract, and silymarin remarkably showed the hepatoprotective effect in the albino mice. The results concluded that *C. cyminum* has a better hepatoprotective effect than *P. emblica* (Abbas *et*

*al*., 2017).

Anti-oxidant activity and free radical scavenging activity: Thiobarbituric acid reactive substances (TBARS) assay was used to evaluate the lipid peroxidation of *Cuminum cyminum* extract. The extract produced significant lipid peroxidation inhibition in comparison with known antioxidant ascorbic acid in both rat liver and brain. The effect of Cuminum cyminum was investigated on alcohol and thermally oxidized oil-induced hyper-lipidemia. The results indicate that cumin can decrease the lipid levels in alcohol and thermally oxidized oil-induced hepatotoxicity (Aruna *et al*., 2005; Atrooz, 2013).

Analgesic, anti-inflammatory, and stimulatory activity: Treatments supplemented with *C. cyminum* affect several inflammatory biomarkers, such as adiponectin, high-sensitivity C-reactive protein (hs-CRP), and TNF-α (Srinivasan, 2018). Water-soluble *C. cyminum* polysaccharides possess lower molecular weight and effectively stimulate RAW264.7 and NK-92 cells to express interleukin (IL)-1β, IL-6, IL-12, and tumor necrosis factor (TNF)-α inflammatory cytokine, and release nitric oxide (Milan *et al*., 2008; Tabarsa, 2020). *Cuminum cyminum* aqueous and ethanolic extracts at doses of 200 and 500 mg/kg were subjected to the hot plate method, writing test, Carrageenan-induced paw edema, and Cotton-pellet granuloma. Both the aqueous and ethanolic extracts showed significant anti-inflammatory activity in Carrageenan-induced paw edema and Cotton-pellet granuloma models when compared to the control group (Bhat *et al*., 2014).

(iv) *Tamarindus indicus*. L

Hepatoprotective activity: The study investigated the hepatoprotective activity of the ethanolic extract of *Tamarindus indica* stem bark (EETI) against the induced DIHD in Sprague Dawley rats. EETI possessed hepatoprotective activity against DIHD in rats (Meena *et al*., 2018). Liman and Atawodi (2014) investigated the hepatoprotective and nephroprotective potential of the methanolic extracts of the seeds, fruit pulp, leaves, stem bark, fruit bark and roots of *Tamarindus indica* Linn in acute and chronic rat model of organ injuries (Liman and Atawodi, 2014).

Anti-oxidant activity and free radical scavenging activity: *T. indica* bark shows the presence of phytochemicals like phenolic compounds, tannins, and steroids. Extracts of *T. indica* bark also exhibited significant anti-oxidant activity, thus establishing the extracts as an anti-oxidant (Tyagi *et al*., 2020).

Analgesic, anti-inflammatory, and stimulatory activity: The anti-inflammatory and analgesic effects of the extracts from the different parts of *T. indica* may be due to its ability to COX-2 expression, inducible nitric oxide synthase (iNOS), 5-lipoxygenase biosynthesis, and TNF. The analgesic activity of *T. indica* may be through the activation of the opioidergic mechanism at both the peripheral and central levels (Komakech *et al*., 2019).

(v) *Euphorbia antiquorum* L.

Hepatoprotective activity: The *in vitro* study showed significant dose-dependent hepato-protection (at 125 mg/kg and 250 mg/kg dose) by altering the activity of bilirubin, serum enzymes, cholesterol, triglycerides, and lipid peroxidation while it significantly increased the glutathione levels of tissue in a dose dependant manner. Previous work reported the hepatoprotective and antioxidant activities of *Euphorbia antiquorum* extract are significantly comparable to standard Silymarin and sodium metabisulphite and claims it may be used for the treatment of jaundice (Jyothi *et al*., 2008). The *E. antiquorum* Linn was evaluated for antioxidant, *in vivo* hepatoprotective activity to validate its claim in traditions. The activity of different doses of *Euphorbia antiquorum* extract (at 20 ug ,40 ug, 60 ug, 80 ug, and 100 ug/ml) exerted *in vitro* significant antioxidant activity as it caused reducing power, hydroxyl, and superoxide anion radical scavenging activities and inhibition properties. In the *in vivo* study, two test extracts of silymarin exhibited marked hepatoprotection against the toxic dose of

Table 2: Ingredients of ***Anal chooranam*** with the common names, parts used, taste of each drug and its five-element perspective, Siddha medicinal uses of the drug

| S. No. | Name of the drug | Parts used | Suvai (Taste) | Pancha Bootham | Siddha medicinal uses |
|---|---|---|---|---|---|
| 1 | *Cissus quadrangularis* L. *(Pirandai)* | Stalk | *Karpu* (Acrid) | Air + Fire | Stomachic, *Mantham* (Indigestion), *kunmam* (Gastriculcer), *Kuruthikazhichal* (Dysentry) |
| 2 | *Smilax chinensis* L. *(Parangippattai)* | Rhizome | *Inippu* (Sweet) | Earth+Water | *Neervetkai* (Thirst), *Valinoi* (Prickingpain), *vanthi* (Vomiting), *Pun* ( ulcers) |
| 3 | *Cuminum cyminum* L. *(Seeragam)* | Seed | *Karpu* (Acrid) *Inippu* (Sweet) | Air + Fire Earth+Water | *Vayitru vali* (Abdominal pain), *Eeralnoi* (liver disease), *kasam* (Cough), *kalladaippu* (Renal caliculi), *Kuruthi kazhichal*( Dysentry) |
| 4 | *Tamarindus indica* L. *(Puli)* | Bark | *Thuvarppu* (Astringent) | Earth+ air | *Kunmam* (gastriculcers), *Kazhichal* (Diarrhoea), *Suram* (Fever), *Seriyamai* (Indigestion) Stomachic |
| 5 | *Euphorbia antiquorum* L. *( Sathurakalli)* | Stem, Latex | *Karpu* (Acrid) | Air + Fire | *Soolai* (prickingpain), *Perunoi* (Leprosy). *Gunmam* (Gastriculcer), *kanakadi* (urticaria) |
| 6 | *Sotruppu* (Sodium Chloride) | - | Uppu (Salt) | Water+fire | *Kazhuthukkazhalai* (cervical lymphadenopathy), *kapam* (Phlegm), *kalleeral noi* (liver diseases), *gunmam* (gastriculcers), *Seriyamai* (indigestion), Stomachic, emetic |

$CCL_4$. The results proved its therapeutic claim that *Euphorbia antiquorum* could be a potential source of natural antioxidants and hepatoprotection (Gait, 2012).

Anti-oxidant activity and free radical scavenging activity: The DPPH radical was used to investigate the scavenging activities of several natural compounds such as phenolic compounds, anthocyanins, or crude extracts of plants. It is a stable nitrogen-centered free radical commonly used for testing the radical scavenging activity of the compound or plant extracts (Chang *et al*., 2007; Pavithra and Vadivukkarasi, 2014). *Euphorbia antiquorum* contains a variety of phytochemical compounds, which exhibited significant free radical scavenging activity. The presence of phenolic compounds can effectively prevent free radical-mediated cell damage by free radical scavenging activity and can be used as a potent source of natural antioxidant compounds (Rice Evans, 1995).

Analgesic, anti-inflammatory, and stimulatory activity: The study evaluated the analgesic and anti-inflammatory effect of the aqueous ethanolic extract of the whole plant at the doses of 250 and 500 mg $kg^{-1}$ body weight of Swiss albino mice. The extract was also investigated for the anti-inflammatory effect on Long Evans rats at the above-mentioned doses using the Carrageenan-induced rat paw edema method. In the acetic acid-induced Writhing test, the extract produced a maximum inhibition of the Writhing reaction by 51.13% ($p<0.001$), which is comparable to that of the standard drug Diclofenac sodium (58.80%) (Das *et al*., 2015).

## Conclusion

The present review revealed that the *Anal chooranam* can be used as a safe, cost-effective

drug choice for the management of *Kamalai* (Jaundice). The ingredients present in *Anal chooranam* possess pharmacological activities like hepatoprotective, antioxidant, and anti-inflammatory properties, etc. In addition, the bioactive components present in the ingredients are mostly phenyl compounds, coumarins, terpenoids, steroids, and alkaloids which are responsible for hepatoprotective activity. By reviewing the literature, it can be concluded that *Anal chooranam* contains a higher proportion of phytochemicals and pharmacological activities which would be responsible for its significant effect on *Kamalai* (Jaundice). Hence, a more detailed investigation must be carried out to obtain a scientific approach to this formulation and develop it as a potent hepatoprotective drug.

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