Review Article

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A CONSPECTUS ON SIDDHA POLYHERBAL FORMULATION: PARANGICHAKKAI CHOORNAM

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ABSTRACT
Siddha system of medicine is one of the ancient systems contemporaneous with those of other traditional system of medicine. The unique nature of this system is its continuous service to humanity for more than 5000 years in combating diseases and in maintaining physical, mental and moral health. Siddha classical texts have numerous polyherbal formulations one among them is Parangichakkai choornam [PPC]. It is one of the safe and efficacious medicines used traditionally for the treatment of various ailments. This review describes various facets like active constituents, morphological characters and pharmacological properties of its individual ingredients. In various pharmacological studies undergone earlier the drugs of Parangichakkai choornam showed antimicrobial, antihelminthic, anti oxidant, anticancer, hepatoprotective property. This review is carried out to scientifically vindicate the traditional use of Parangichakkai choornam.
Keywords: Siddha, Parangichakkai choornam, *Smilax chinensis, Indigofera aspalathoides, Enicostemma littorale*, *Azima tetracantha,* active constituents, pharmacological activity, antimicrobial, antioxidant.

INTRODUCTION

"To experience illness is not itself misfortune,
But being defeated by illness is misfortune".
Daisaku Ikeda.

To wallop this misfortune choice of medicine is more important. Herbs and herbal drugs have drawn people due to their various clinically proven effects and lack of side effects. Moreover the frequent use of synthetic drugs even for smaller ailments that result in higher incidence of adverse drug reaction has also made us to revert to nature for safer herbal medicines. Parangichakkai choornam is one such medicine.

Parangichakkai choornam

Parangichakkai choornam is a powder based herbal drug. It is an amalgamation of four main drugs and two sub drugs. It has been mentioned in the Chikitcha Rathna Deepam, a siddha classical text. The botanical nomenclature, family name and medicinal uses are listed in Table 1.

Method to prepare Parangichakkai choornam

Sathuracalli and tirucalli are cut into pieces and transferred into earthenware. Water is poured into the earthenware (Figure 1), the mouth of which is then closed using white cotton cloth (Figure 2). Parangichakkai is made into pieces and spread over the cotton cloth. Suitable earthenware is placed above the earthenware and sealed using clay (Figure 3). This setup is placed in stove and heated for 5 hours (Figure 3). The seal is removed carefully after one hour. Parangichakkai and all other drugs are shade dried and made into powder individually. Then the above powders are mixed well and sugar is added to this mixture. This mixture is made into new earthenware and kept in dhaniya pudam for 10 days. This pudam is believed to increase the efficacy of medicine[1].

Studies on Drugs of Parangichakkai Choornam

Various literatures have been reviewed to substantiate the traditional therapeutic effects on modern scientific parameters. Each drugs of Parangichakkai choornam are therapeutically potential and various studies have been conducted on them. In this review the morphological characters, chemical constituents, traditional therapeutic uses and pharmacological studies of individual ingredients of Parangichakkai choornam are discussed.

Smilax chinensis Linn

Morphological characters

It is a woody vine armed with small thorns all over the stem. Rhizomes are long, thick and grey colored. Leaves are simple, alternate, elliptically oblong to sub rounded and those toward the end of the branches are much smaller and veined. Petioles are with adnate spiculate stipules which frequently extended into tendrils. Inflorescence arises from the upper leaf axils. Flowers are white to yellowish-green; their pedicels are subtended by bracteoles, umbellate. Berries are globose, reddish when ripe[2].

Chemical constituents

Smilax saponins, 16-hentriacontanone, β-Carotene neo-β-carotene, cryptoxanthin, lutein, lutein epoxide. 4-methylene, 4-methyl-glutamic acid, arginine, N-a-acylarginine, acidic N-a-acylarginine derivatives[3]. Cinchonin, smilacin, steroidal saponin, tigogenin, neo tigogenin, laxogenin, isonarthogenin, pseudoprotodiosicin, diosicin, diosgenin, isocery-5-methylcyteamine-sulphoxide, oleic acid, rutin, smilax saponin A,B,C[4-7] kaemperol-7-O-beta-D-glucopyranoside, engeletin, isoengeletin, kaempferol, dihydrokaempferol, dihydrokaempferol-5-O-P-D-glucopyranoside, rutin, kaempferol-5-O-beta-D-glucopyranoside, 3, 5, 4'-trihydroxystibene, vanillic acid, 3, 5-dimethoxy4-O-beta-

D-glu-copyranosylcinnamic acid, beta-sitosterol, and beta-daucosterol[8]. Stilbenes and Flavonoids: taxifolin-3-O-glycoside, piceid, oxyresveratrol, engeletin, resveratrol and scirpusin A[9]. Phenylpropanoids: smilasides A-F (1-6), and three known phenylpropanoids, smiglaside E, heloniosides B, and 2',6'-diacetyl-3,6-diferuloylsucrose[10].

Pharmacological studies

Anti-inflammatory activity

Sieboldogenin present in *Smilax china* showed significant lipoxygenase inhibition (IC50: 38 μM). It also exhibited significant inhibition ($p < 0.05$) of carrageenan-induced hind paw edema at the doses of 10 and 50 mg/kg. Computational molecular docking showed its molecular interaction with important amino acid residues in the catalytic site of lipoxygenase, revealing its potential binding mode at molecular level[11].

Anticancer activity

The anticancer activity of eight crude extracts of *Smilax china* rhizome (SCR) against HeLa cells was assessed by MTT assay and clonogenic assay, the fraction rich in flavonoids had shown good activity against HeLa cells. A bioassay-guided separation on this extract lead to the detection of kaempferol-7-*O*-β-D-glucoside (KG), which belongs to flavonoid glycoside, displayed marked anticancer activity[12].

Hepatoprotective activity

Smilax chinensis extract affords hepatoprotection against carbontetrachloride through cell membrane stabilization and hepatic cell regeneration[13].

Antioxidant activity

The ethyl acetate fraction of *Smilax china* showed the highest antioxidant property, correlating with the high phenolic levels, particularly catechin and epicatechin[14]. The alcoholic extract of *Smilax china* protects the induction of lipid peroxidation, induced by $FeSO_4$. This may be due to chelation of iron, conversion of Fe^{2+} to Fe^{3+}, by increased level of reduced glutathione, or by scavenging hydroxyl, superoxide radicals, and other oxygen molecules responsible for lipid peroxidation [15]. The ethanolic extract of *Smilax china* rhizomes at 100 and 200 mg/kg b.w doses showed significant testicular free radical scavenging activity and restoration to normal spermatological parameters[16].

Antidiabetic activity

The methanolic extract of *Smilax china* has significant Anti diabetic activity in Alloxan induced diabetes in rats. The maximum reduction in glucose level was seen at the dose of 400 mg/kg b.w. The antidiabetic activity may be due to promotion of insulin secretion by closure of potassium - ATP channels, membrane depolarization and stimulation of Calcium influx, an initial key step in insulin secretion[17].

Anti-inflammatory and Analgesic activity

The ethyl acetate and methanolic extract of *Smilax china* showed dose dependent anti-inflammatory activity and produced reduction in the duration of licking in the late phase in analgesic activity, which was found to be statistically significant at higher concentration in acute carrageenan induced rat paw edema model and eddy's hot plate method respectively[18].

Anti-hyperuricemic activity

Ethylacetate fraction (250 mg/kg) of *Smilax chinensis* exhibited stronger anti-hyperuricemic activity in hyperuricemic mice. Caffeic acid, resveratrol, rutin and oxyresveratrol isolated from ethylacetate fraction showed different inhibitory activities on xanthine oxidase *in vitro*, with the IC (50) values of 42.60, 37.53, 42.20 and 40.69 μM, respectively, and exhibited competitive or mixed inhibitory actions. Moreover, it (125, 250 and 500 mg/kg) markedly reversed the serum uric acid level ($p < 0.05$, $p < 0.01$ and $p < 0.001$, respectively), fractional excretion of urate ($p < 0.05$, $p < 0.01$ and $p < 0.01$, respectively) and blood urea nitrogen ($p < 0.05$, $p < 0.01$ and $p < 0.01$, respectively) to their normal states, and prevented the renal damage against tubulointerstitial pathologies in hyperuricemic rats[19].

Traditional uses

It is used in Indian system of medicine as a depurative, diaphoretic, stimulant, anti syphilitic, sudoforic, demulucent tonic and as aphroadisiac in the form of decotion – 1 oz thrice daily. It is boiled in milk to which mastaki, cardamons, and cinnamom are added and taken internally in rheumatism, gout, chronic nervous diseases, cachexia, seminal weakness and constitutional syphilis[20]. In korea it is used as a remedy for inflammatory disease and ischuria. Inhalation of roots used in asthma. In Philippines, decoction of the roots and rhizomes are used as depurative in cases of herpetism and syphilis[2].

***Indigofera aspalathoides* Vahl**

Morphological Characters

A low much branched under shrub: branches rigid, terete, divaricately spreading, the young ones argenteo-canescent, the hairs soon falling off, the olderones are purple and nearly glabrous. Leaves 1-5 (often 3) foliate, digitate, sessile and crowded on the young branches but soon deciduous, stipules minute, subulate. Leaflets 2.5-6 mm long sessile, linear or oblanceolate, apiculate rather fleshy with white appressed hairs. Flowers solitary, axillary, filiform longer than leaves but shorter than pods. Calyx 1.5 mm long, teeth linear subulate, corolla dark pink exserted. Pods 1.2-1.5 mm long, somewhat huge, straight, glabrousor with few scatterd hairs. Seed 6-8[21].

Chemical constituents

The phytochemical analysis carried out by Bojaxa A Rosy *et al* shows that except napthoquinone all other secondary metabolites like steroids, triterpenes, alkaloids, phenolic groups, flavones, saponin, tannin, sugar, catachin, amino acid and reducing sugar were present[22]. Spectrophotometric methods were used to study the total content of phenols and tannins of *Indigofera aspalathoides*. The plant was found to be rich in phenols (47.38 ± 1.532) than tannins (34.59 ± 1.788)[23]. Indigocarpan, a new compound and mucronulatol, a known compound were isolated from chloroform extracts

of *Indigofera aspalathoides*. Spectroscopic methods including single x-ray analysis were used to describe their structure[24]. GC-MS analysis done on methanolic extract of *Indigofera aspalathoides* (Table 2) showed ten major peaks that points out the phytoconstitutents present in it. Among them Dodecanoicacid acid, tetradecanoic acid and n-Hexadecanoic acid possesses anti-oxidant and antimicrobial properties[25].

Pharmacological studies

Antimicrobial activity

Disc diffusion method was used to study the antifungal activity of various extracts of *Indigofera aspalathoides*. Maximum inhibitory activity against (*Candida albicans; Candida parapsilosis; Candida tropicallis*) was shown by methanolic extract with zone of inhibition - 13 mm, 14 mm and 16 mm, respectively followed by ethyl acetate (zone of inhibition of 13 mm, 15 mm and 16 mm respectively) and hexane (zone of inhibition of 15 mm, 16 mm and 18 mm respectively). The test pathogen was effectively inhibited by methanolic extract[26]. Disc agar method was adopted to test the antimicrobial activity of various extracts of leaves and roots of *Indigofera aspalathoides* against 13 microbial species including 8 bacteria and 5 molds. The petroleum ether, chloroform and acetone leaf and root extracts of this plant shows only antibacterial activity against *B. cereus, E. aerogens, S. typhi, P. vulgaris* and *S. aureus,* while the methanol extract shows both antibacterial and antifungal activity. Though the methanol root extract shows significant anti microbial activity, the maximum inhibition zone was seen against *P. vulgaris* (22 mm). Among the leaf and root extracts, the root extracts showed superior antibacterial and antifungal activity[27].

Anti-cancer activity

Ehrlich ascites carcinoma (EAC) tumor model was used to evaluate the antitumor activity of ethanolic extract of *Indigofera aspalathoides* (EIA). The survival time and normal peritoneal cell counts were increased. Hematological parameters and proteins which were altered by tumor inoculation were also restored[28]. Male albino rats were used to study the antioxidant and anticancer effects of the aqueous extract of *Indigofera aspalathoides* on fibrosarcoma. Antioxidant enzymes like catalase (CAT), glutathione peroxidase (GPx) and superoxide dismutase (SOD) were analyzed in blood serum, liver, and kidney of control and experimental animals. On treatment with aqueous extract of *Indigofera aspalathoides*, the serum levels were corrected to near normalcy in fibrosarcoma-bearing animals. 20-MCA-induced fibrosarcoma male albino rats showed enhanced recovery because of its antioxidant property[29]. Carcinogenesis was induced chemically in rats to investigate the chemopreventive affects of *Indigofera aspalathoides*. The observed increase in the levels of DNA, RNA, hexose, hexosamine, and sialic acid in liver and kidney tissues of fibrosarcoma-bearing animals reached to near normal state after the treatment with aqueous extracts of *Indigofera aspalathoides*[30,31]. Transplanted experimental fibro sarcomas model was used to evaluate the therapeutic efficacy of an aqueous extract of *Indigofera aspalathoides*. In drug treated animal group reduced tumor size was noted. There was a significant reduction in hepatic microsomal Phase II enzymes such as UDPGT and GST[32]. Ethanolic extract of *Indigofera aspalathoides* (EEIA) shows marked protection against Dalton's ascitic lymphoma which is assessed by the intraperitoneal injection of 400 mg/kg of)[33]. Chemo preventive effect of ethanol extract of *Indigofera aspalathoides* (250 mg/kg) was studied in male wistar rats. Decrease in the levels of serum glutamate pyruvate transaminase (SGPT), serum glutamate oxaloacetate transaminase (SGOT), alkaline phosphatase (ALP), total bilirubin, gamma glutamate transpeptidase (GGTP), lipid peroxidase (LPO), glutathione peroxidase (Gpx) and glutathione S-transferase (GST) with a concominant increase in enzymatic antioxidant (superoxide dismutase and catalase) levels when compared to those in liver tumor bearing rats reveals that it effectively suppresses the liver tumor induced with DEN[34].

Anti-oxidant activity

Two fractions from the leaves of *Indigofera aspalathoides* were used to study the free radical scavenging activity. DPPH radical, ABTS radical, Nitric oxide radical and hydroxyl radical scavenging assays were carried out. Significant antioxidant activity was observed in both fractions when compared to standard antioxidants. Though the polyphenolic compound content is less in chloroform fraction it exhibits more radical scavenging activity than the ethanol fraction which may be attributed to the structural features of polyphenolic compounds[35]. In antioxidant studies the alcohol extract of *Indigofera aspalathoides* and *Bauhinia variegata* was found to have antioxidant effect against free radicals, LPO, SOD, catalase and GPx generated during paracetamol-induced hepatotoxicity when compared to control group animals[40].

Anti-inflammatory activity

Cyclooxygenase-1 (COX-1) and cyclooxygenase-2 (COX-2) inhibitory activities and antioxidant properties of indigo-carpen and mucronulatol were evaluated. Significant COX-1 inhibition (IC50 30.5 μM) was shown by the compound indigo- carpen and its invivo anti-inflammatory activity was found to be comparable to the standard drug ibuprofen. Molecular docking studies revealed the binding orientations of indigo-carpan in the active sites of COX-1 and COX-2[24]. Anti-inflammatory activity of alcoholic extract of *Indigofera aspalathoides* was reported by Amala Bhaskar *et al*.,[36] Rajkapoor *et al* also reported anti-inflammatory activity of dried stem of *Indigofera aspalathoides* in rats[37].

Anti-arthritic activity

Complete Freund's adjuvant-induced (CFA-induced) arthritis in rats was used to study the anti arthritic effect of ethanolic extract of stems of *Indigofera aspalathoides* Vahl (EIA). Biochemical parameters and SOD, GPx, LPO and catalase levels were significantly altered in EIA administered arthritic rats that prove an eminent anti-arthritic effect of EIA against CFA-induced arthritis in rats[38].

Hepatoprotective activity

CCl4-induced hepatic damage rat model was used to study the Anti-hepatotoxic effect of the alcoholic extract of stem of *Indigofera aspalathoides.* Biochemical analysis and histopathology studies were done to evaluate this activity. The histopathological changes of liver sample were compared with respective control. The extract showed remarkable hepatoprotective effect[39]. Hepatoprotective effect of ethanolic extracts of *Indigofera aspalathoides* and *Bauhinia variegata* were studied against hepatotoxicant paracetamol. Biochemical parameters such as SGOT, SGPT, ALP, and GGPT which are affected by paracetamol - induced hepatotoxicity reaches to near normal. Regenerative changes in hepatocytes were seen in histopathological studies of liver section after the treatment with alcohol extracts of *Indigofera aspalathoides* and *Bauhinia variegata.* Hepatoprotective effect of the alcoholic extract of *Indigofera aspalathoides* and *Bauhinia variegata were* produced in a dose dependent manner[40].

Anti-diabetic activity

Preliminary investigation was carried out to evaluate the antidiabetic effect of the alcoholic extract of *Indigofera aspalathides* by oral glucose tolerance test (OGTT), normoglycemic and anti hyperglycemic activity in streptozotocin – nicotinamide induced non-insulin dependent diabetes mellitus rats. Normal and experimental diabetic rats were administered graded dose (250 and 500 mg/kg) of the alcoholic extract suspended in gum acacia. There was only less remarkable decrease in blood glucose level at both dose levels as compared to glibenclamide. But the normoglycemic study revealed significant percentage of decrease in blood glucose level from the initial value in normal rats 21.20 % and 25.20 % (250 and 500 mg/kg respectively) as compared to the control group 1.85 %. This indicates that alcoholic extract of *Indigofera aspalathoides* is a source of compounds with antidiabetic activity[41].

Nephro-protective activity

Gentamicin induced nephrotoxicity in male wistar albino rats were used to study the methanolic extract of *Indigofera aspalathoides.* The biochemical markers such as blood urea, serum creatinine, serum uric acid, serum electrolytes and antioxidant parameters such as Renal SOD, catalase, LPO and GPx were analyzed. There was significant reduction in elevated serum marker levels and significant increase in renal SOD, catalyse level. The 500 mg/kg dose showed significant nephroprotective effect while the 250 mg/kg dose showed only partial protection which was revealed in the renal histopathology study[42].

Wound healing activity

Excision wound model was used to evaluate the wound healing property of chloroform extract of *Indigofera asphalathoides* vahl. Ex DC. in two different dose levels. Drug treated wound showed higher rate of wound contraction, increased level of hydroxy proline, hexosamine, SOD, ascorbic acid and decreased levels of lipid peroxidases. Histopathological studies also showed progressive collagenation and only few macrophages compared to the control rats[43].

Anti-viral activity

A poly herbal formulation which contains *Indigofera aspalathoides* was investigated for the anti-viral activity (Respiratory viral infection RSV) in Juvenile chinchillas and BALB/c mice. A dose-effect was clearly detectable in chinchillas inoculated with increasing doses of RSV. At the lower dosages assayed, no signs of illness were noted at any time of post challenge in both the groups. But conversely, animals that received higher dosages of the virus without poly herbal formulation treatment showed signs of acute respiratory tract infection. The Nasal lavage fluids collected from the RSV-infected chinchillas (control) had an abnormal yellowish-green tint and was notably turid. Poly herbal formulation treated group of animals does not show such change. Preliminary evidence in support of restriction of viral replication to the upper airway passage following the challenge was supported by the absence of viral plaques in the tracheal mucosa and lung tissue that were collected 4 days after challenge in the treatment group receiving highest dose of RSV. This clearly indicates that treatment with the poly herbal formulation prevents viral multiplication[44].

Traditional uses

The leaves, flowers and tender shoots are said to be cooling and demulcent and are employed in the form of decoction for leprosy and cancerous affections. The root is chewed as a remedy for tooth ache and aphthae. The leaves are also applied to abscesses. The whole plant rubbed up with butter is applied to reduce edematous tumors and a preparation made from the ashes of the burnt plant is used to remove dandruff from the hair. Oil obtained from the root is used to anoint the head in erysipelas[21].

***Enicostemma littorale* Blume**

Morphological characters

Enicostemma littorale is an annual or perennial herb, Stems often winged, rounded or angular. Leaves sessile, often narrow. Inflorescence axillary, dense clusters or cymes. Flowers 5-merous (rarely 3-, 4- or 6-merous), sessile, actinomorphic. Calyx narrow, campanulate, divided down halfway to 2/3, thin with white thinner margins, persistent in fruit with colleters. Corolla small, white, tubular to funnel shaped. Stamens inserted in corolla tube, with appendices at filament bases, filaments equal length, anthers erect after anthesis, with sterile apex[45]. Ovary without nectary disk; stigmas capitate, slightly bi lobed, Fruit a capsule, obovoid, seeds rounded and not winged[46].

Chemical constituents

Many compounds have been isolated from the plant, *E. littorale*. Tanna *et al.* reported that the aerial part of the plant gave 34 % of dry alcoholic extract and 15.7 % of ash[47]. The presence of minerals like iron, potassium, sodium, calcium, magnesium, silica, phosphate, chloride, sulphate and carbonate were estimated in the qualitative analysis of ash. Natarajan and Prasad reported the

presence of five alkaloids, two sterols and volatile oil[48]. Betulin, a triterpene sapogenin was also isolated by earlier workers[49]. Monoterpene alkaloids like enicoflavin, gentiocrucine and seven different flavonoids were isolated from the alcoholic extract and the structures were identified as apigenin, genkwanin, isovitexin, swertisin, saponarin, 5-o glucosylswertisin and 5-o glucosylisoswertisin were also isolated by Goshal *et al*[50]. Catechins, saponins, steroids, sapogenin, triterpenoids, flavonoids and xanthones were identified. A new flavone C-glucoside named as Verticilliside was isolated for the first time from this species and was reported by Jahan *et al*[51]. Swertiamarin compound was isolated from *E. littorale* by using alcoholic extract[52]. Six phenolic acids like vanillic acid, syringic acid, p-hydroxy benzoic acid, protocatechuic acid, p-coumaric acid and ferulic acid were also found by Desai *et al*[53]. Methanol extract of *E. littorale* was found to be containing different aminoacids like L-glutamic acid, tryptophane, alanine, serine, aspartic acid, L-proline, L-tyrosine, threonine, phenyl alanine, L-histidine monohydrochloride, methionine, isoleucine, L-arginine monohydrochloride, DOPA, L-Glycine, 2-amino butyric acid and valine[54]. Swertiamarin is a representative constituent of many crude drugs, which are marketed in Japan and other countries and these crude drugs are normally evaluated by their high swertiamarin content[55,56].

Pharmacological studies

Antimicrobial activity

The anti-fungal activity of hexane, chloroform, ethyl acetate, ethanol and water extracts (100, 200, 400 mcg/ml) of *Enicostemma littorale* was carried out. The hexane extract shows moderate activity against *Aspergillus niger* and slight activity against *Candida albicans*. The chloroform extract shows pronounced activity against *Aspergillus niger* and negligible activity against *Candida albicans* at the concentration of 100, 200 mcg/ml. The ethylacetate extract shows slight activity against *Aspergillus niger* and moderate activity against *Candida albicans*. The ethanol extract shows pronounced activity against *Aspergillus niger* and *Candida albicans*. The water extract shows slight activity against *Aspergillus niger* and *Candida albicans*[57]. Sharada L Deore *et al* observed antimicrobial activity against *Bacillus subtilis, S. aureus, Proteus vulgaris, Pseudomonas aeruginosa, Shigella sonni* with choloroform, ethyl acetate, hydro alcoholic extract, aqeous and methanolic extract of *E. axillare*. It is observed that choloroform, ethyl acetate, hydro alcoholic extract showed prominent activity than aqueous and methanol extracts[58]. Chloroform, methanol and acetone extracts of different parts of *E. littorale* (leaf, stem and root) were evaluated for antimicrobial activity using disc diffusion method against some gram-negative species such as *Escherichia coli, Klebsiella pnemoniae, Pseudomonas aeruginosa, Salmonella typhi* and gram-positive species *Staphylococcus aureus, Bacillus cereus, Bacillus subtilis* and two fungal species viz., *Aspergillus fumigates* and *Aspergillus flavus*[59].

Anthelmintic activity of *E. littorale*

Mishra and Shukla reported that *E. littorale* exhibits antihelminthic effects. Petroleum ether and ethanolic extracts of aerial parts of *E. littorale* Blume were prepared and evaluated separately for finding an antihelminthic effect on adult Indian earthworm, *Pheretima posthuma*. Five different concentrations of each extracts were used in this antihelminthic activity, in which the time of paralysis and death of the worm were determined. The results indicated that an ethanolic extract of *E. littorale* was more potent than the petroleum ether extract[60].

Antinociceptive effect

Jaishree V *et al*, studied *in vivo* anti-nociceptive activity of swertiamarin isolated from *E. axillare* using hot plate method, tail withdrawal reflex method and acetic acid induced writhing method. In the hot plate method and tail withdrawal reflex method swertiamarin treatment showed potent activity than standard paracetamol. In the acetic acid induced writhing, swertiamarin reduced the number of writhes significantly. These results proved that swertiamarin from *E. axillare* possess both peripheral and central antinociceptive activity[61].

Antioxidant activity

Thirumalai *et al.* studied the hypolipidemic and antioxidant effects on hepatically injured male albino rats (ethanol induced) by treating with aqueous leaf extract of *E. littorale* at a dosage of 250 mg/kg body weight. He reported that aqueous leaf extract of *E. littorale* blume has potent restorative effect on hyperlipidaemia and oxidative stress[62]. Mukundray *et al.* investigated the role of *E. littorale* Blume as a promising antioxidant therapy in gentamicin iduced nephrotoxicity in rats. Gentamicin treated animals showed high oxidative stress in mitochondrial as well as post-mitochondrial fractions of renal tissues as evidenced by increased lipid peroxidation levels, activities of antioxidant enzymes, SOD and GPx. Treatment with *E. littorale* ameliorates antioxidant defense system of mitochondrial as well as post mitochondrial fraction, with better improvement seen in mitochondrial fraction[63].

Antiulcer and anti-inflammatory activity

The aerial parts of *E. littorale* against aspirin, ethanol and pyloric ligation induced ulcers in rats and bovine serum albumin (BSA) denaturation were examined for antiulcer and anti-inflammatory effects by Roy *et al*. Pre-treatment with the aqueous extract of *E. littorale* showed a dose-dependent decrease in the ulcer index against aspirin, ethanol challenge and pyloric ligation. The prior administration of the aqueous extract also reduces the total acidity, free acidity, volume of gastric secretion and elevated the gastric pH. In addition, it was also observed that the aqueous extract inhibits the serum albumin denaturation in a dose-dependent manner. It was reported that the methanolic extract of *E. littorale* possesses antiulcer activity. Its anti-inflammatory activity may be attributed to the antioxidant potential[64].

Antitumor activity

The antitumor activity of methanolic extract of *E. littorale* has been evaluated against Dalton's ascitic lymphoma (DAL) in Swiss albino mice by Kavimani *et al*. A significant enhancement of mean survival time of methanolic extract of *E. littorale* treated tumor bearing mice was found with respect to control group. Treating with methanolic extract of *E. littorale* enhances peritoneal cell counts. When these methanolic extract of *E. littorale* treated animals underwent intraperitoneal inoculation with DAL cells, tumor cell growth was found to be inhibited. After 14 days of inoculation, methanolic extract of *E. littorale* is able to reverse the changes in the haematological parameters, protein and PCV consequent to tumor inoculation[65].

Hepatoprotective activity

Water extract of aerial parts of *E. littorale* was used to evaluate the hepatoprotective activity against paracetamol induced hepatic damage in albino rats. It showed very significant hepatoprotection against paracetamol induced hepatotoxicity in albino rats in reducing serum total bilirubin, SALP, SGPT and SGOT levels. It is also found that treatment with water extract of plant has brought down the elevated level of LPO and also significantly enhanced the reduced levels of SOD, CAT, GPX, GST and GSH[66]. The hepatomodulatory response of ethanol extract of *E. littorale* Blume were examined for oxidative stress induced liver injury by carbon tetrachloride (CCl_4) in albino wistar male rats. *E. littorale* extract was given along with Ccl_4. Supplementation of *E. littorale* extract significantly increases glutathione, GPx, SOD, CAT, and vitamin-C in the liver, with a dose-dependent reduction of the TBARS as evidenced by reduced lipid peroxidation, total cholesterol and triglycerides levels in hepatic cells and it was significantly depleted in the treated group when compared to that of control group. Further, the hepatic marker levels were also restored to normal level dose-dependently after the supplementation of *E. littorale* extract in comparison to respective controls[67].

Hypoglycemic activity

The whole plant aqueous extract of *E. littorale* was tested for its hypoglycemic activity on normoglycemic, hyperglycemic and alloxan induced diabetic rats. Blood sugar lowering activity was not observed in normoglycemic and glucose loaded hyperglycemic rats in the short time experiment. But in case of diabetic rats, the fall of blood sugar after 30 days treatment with the aqueous extract was found to be significant ($P < 0.001$). The decrease in the plasma glucose level was accompanied with decrease in the level of glycosylated haemoglobin and glucose-6-phosphatase activity in liver[68]. Jyoti Maroo *et al* studied the glucose lowering and antioxidant effect of a methanol extract of *Enicostemma littorale* Blume was evaluated in alloxan-induced diabetic rats. Administration of methanol extract (2.5 g/kg body weight/day) to diabetic rats for 20 days reduced blood glucose levels from 466.50 ± 37.07 to 237.20 ± 28.22 (P andlt; 0.01). *E. littorale* also increased the serum insulin levels of diabetic rats and improved the antioxidant status of diabetic rats. Extract treatment to the diabetic rats significantly increased reduced glutathione levels and decreased erythrocyte catalase activity[69]. Vishwakarma *et al*. standardized the dose dependent effect with hot and cold aqueous extracts of *E. littorale* for three weeks in STZ induced type 1 diabetic rats. The result suggested that *E. littorale* possesses potential antidiabetic activity and improves lipid profile at a dose of 0.5 g/kg[70].

Nutritional information

Daily uptake of 2 g of *E. littorale* fresh leaves is recommended for diabetic patients since it's highly nutritious. According to a nutritional analysis of *E. littorale* by the National Institute of Nutrition, Indian Council of Medical Research, 100 g fresh *E. littorale* greens contain 140 Kcal energy, 7 g protein, 0.7 g fat, 26.5 g carbohydrates, 4.2 g fiber, 8.4 g minerals, 49.9 mg iron, 1,641 mg calcium, 81 mg phosphorous, and 53.2 g moisture[71].

Traditional uses

In siddha system of medicine, it is used in the treatment of utricaria, neurofibroma, leucorrhea, ulcer, intestinal disorders, arthritis etc. Whole plant is grinded and applied over the utricarial rashes. Whole plant grinded with small amount of pepper and garlic is added to milk and given for prulent leucorrhea. It is bitter; it acts as stomachic, tonic, alterative, laxative and febrifuge[72].

***Azima tetracantha* Lam**

Morphological characters

Scrambling, spiny shrub or small tree of about 5 m long, Bark green on younger branches, turning brown, young twigs sometimes square in cross-section, hairy; characteristic whorls of four long straight spines occur along the length of branches at each of the leaf axils. Oval to circular, opposite or nearly so, each pair at right angles to the previous and following one; light green, leathery and usually hairy; apex has a sharp tip, margin entire, tapering at both ends, short petiole. Dioecious; light green or yellow, small flower clusters in axils; floral parts in fours; petals re curving, calyx bell-shaped. Round berry of 1 cm in diameter with a sharp apical tip; fleshy, light-colored, containing one or two seeds; ripe from summer into the next winter[73]. The root-bark has wide, well developed superficial periderm wide pseudocortex and wide secondary phloem[74].

Chemical constituents

High concentrations of N-methoxy-3-indolylmethyl-glucosinolate, a common glucosinolate of Brassica crops such as Brussels sprouts and broccoli, were found in the roots and seeds of *A. tetracantha*. The roots also contained another indole glucosinolate that was provisionally identified, from MS data and comparison with indole glucosinolate standards, as N-hydroxy-3-indolymethyl-glucosinolate. The roots, stems, and leaves contained neoascorbigen (the condensation product of N-methoxy-indole-3-carbinol and ascorbic acid)[75]. The dimeric piperidine alkaloids azimine, azcarpine and carpaine have been isolated from all plant parts. Terpenoids are present in the roots and the leaves[76].

Pharmacological Studies

Balakrishnan *et al*., 2012 reported that in the liver sections of the rats treated with ethanolic extract of *A. tetracantha* (EEAT) root bark extract for 7 days, the normal cellular architecture was retained there by further confirming the potent hepatoprotective effect of EEAT root bark. The ethanol (50 %) extract of *Azima tetracantha* Lam. (EEAT) root bark afforded significant protection against CCl4 induced hepatocellular injury[77].

Traditional uses

In East Africa the pounded roots of *Azima tetracantha* are applied directly to snakebites and an infusion is taken orally as a treatment for them, while in Zimbabwe a mixture of roots and leaves is used similarly. The Bajun people of the Kenyan coast use a root decoction to treat stomach disorders. In India and Sri Lanka the root, root bark and leaves are added to food as a remedy for rheumatism[76].

Table 1: Parangichakkai choornam

Tamil name	Botanical name	Family name	Medicinal uses as mentioned in
Parangichakkai (Root tuber)	*Smilax chinensis*	Liliaceae	**Siddha** Kranthi, Soolai, Megam, Vettai, Vandukadi, Padaigal, Viranangal, Kandamalai
Sivanarvembu (Whole plant)	*Indigofera aspalathoides*	Fabaceae	
Vellarugu (Whole plant)	*Enicostemma littorale*	Gentianaceae	
Sangam (Root bark)	*Azima tetracantha*	Salvodaraceae	
Sathuracalli (Whole plant)	*Euphorbia antiquorum*	Euphorbiaceae	
Tirugucalli (Whole plant)	*Euphorbia tirucalli*	Euphorbiaceae	

Table 2: GC-MS analysis of *Indigofera aspalathoides*

S. No.	RT	Name of the compound	Molecular formula	MW	Peak Area
1.	10.99	Dodecanoic acid	$C_{12}H_{24}O_2$	200	1.61
2.	13.47	Tetradecanoic acid	$C_{14}H_{28}O_2$	228	39.70
3.	16.34	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256	11.14
4.	18.96	9,12-Octadecadienoic acid (Z,Z)	$C_{18}H_{32}O_2$	280	5.45
5.	19.37	Oleic Acid	$C_{18}H_{34}O_2$	282	6.46
6.	19.03	Octadecanoic acid	$C_{18}H_{36}O_2$	284	1.31
7.	20.95	Kaur-16-ene3	$C_{20}H_{32}O_2$	272	1.98
8.	21.26	Pregnanetrial	$C_{21}H_{36}O_3$	336	4.83
9.	22.35	5-(1-Lsopropenyl-4,5dimethylbicyclo(4.3.0) nonan-5-yl)-3-methyl-2-pentenol acetate	$C_{22}H_{36}O_2$	332	3.15
10.	0.02	2-Methoxy-4α-methylandrost-2-en-17ol-l-one 5β	$C_{21}H_{32}O_3$	332	24.38[25]

Figure 1: Earthern ware with calli

Figure 2: Ware closed with cloth

Figure 3: After sealing with clay

Figure 4: Parangichakkai

Figure 5: Sivanarvembu

Figure 6: Vellarugu

Figure 7: Sangam plant

Figure 8: Sangam root

Figure 9: Tirucalli

Figure 10: Sathuracalli

CONCLUSION

Traditional system of medicines, which utilize mostly plant based prescriptions, has now become a source of primary health care among the rural communities of developing countries. Rich heritage of flora and centuries of experience in healing has become an added advantage to Indian system of medicine. The ingredients of Parangichakkai choornam are simple, effective and has broad spectrum of activity. The drugs of Parangichakkai choornam are bitter in taste and can hence be used in the treatment of diseases of Pitha and kabha origin Parangichakkai choornam is therapeutically indicated for diseases like Kranthi (tumor), Viranam (Wound), Megam (Diabetes), Vettai (Leucorrhea) etc which are also of pitha and kabha origin. This review distinctly exposes that ingredients of Parangichakkai choornam have antimicrobial, anti-inflammatory, anti diabetic, and hepatoprotective activities in common. These properties play a key role in the treatment of above mentioned diseases. This undoubtedly points out the Siddha perceptive scientific knowledge of combining drugs in a formulation. Thus the drug Parangichakkai choornam unfailingly appeases both the traditional and scientific community. To attain a scientific stature, further studies on its safety and efficacy has to be carried out. When scientifically proved, the Parangichakkai choornam will be a blissful drug.

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