Review Article

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PAVALAM: A VALUABLE SIDDHA MINERAL DRUG

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ABSTRACT
The marine ecosystem is a rich source of drug discovery and development. Pharmacological investigations of marine products are providing convincing evidence that marine drug discovery has an exceedingly bright future in health care. The availability of ethno medicinal literature about marine products is very limited. Marine organisms have been used in Siddha system of Medicine since time immemorial. Pavalam (Red coral) is a valuable mineral drug which is commonly used in day to day practice by Siddha physicians for various ailments. This paper focuses on its origin, character, purification and processing techniques and different form of medicines prepared. The literature review revealed that Pavalam based medicines are widely used for the management of respiratory diseases, bleeding disorders and life style diseases like cancer and diabetes. The various research reports on Pavalam through scientific validation also highlighted for its future development. The scientific reports confirm the traditional claim of Pavalam's efficacy.
Keywords: Pavalam, red coral, Siddha system, mineral drug, research, scientific validation

INTRODUCTION

Siddha medicine is one of the oldest[1] and lesser known system of medicine[2] which was regionally confined to Tamil Nadu, India and its adjoining areas among Tamil speaking people[3]. This medicine was said to be developed by the Siddhars, the ancient super natural Indian saints. It is a unique healing system that treats not only the body but also rejuvenates the soul. Siddha Materia Medica comprises of Mooligai (plants), Thathu (inorganic substances) and Jeevam (animal products). Sage Bogar classified the inorganic materials into 4 major classifications known as Ulogam (Metals), Karasaram (Minerals), Uparasam (Secondary minerals) and Pasanam (Arsenic compounds)[4]. Ethno medicine provides many efficient drugs for human ailments. The literature available in marine ethno medicine is very limited[5]. Research on marine organisms began in the last century but a number of marine products are in use in Siddha system of medicine, since time immemorial. Pearl, coral, oyster shell, conch shell, turtle and cowry are some examples used as medicines in this system**.** Pavalam (Coral) is used to treat Kaba diseases, Osteoporosis, Bleeding disorders, Cough, Insect bite, Spermatorrhoea, Bronchial asthma and Diabetes. It is classified under the topic Uparasam by sage Bogar.[6] Corals are small sedentary marine animals that occur in dense colonies in warm shallow water of the oceans. Coral reefs are referred as "Tropical rain forest of the deep", since they are the most diverse, productive, beautiful marine organism providing valuable scientific insights into the nature of underwater ecology[7].

Geographical Distribution

It has a fragmented pattern of distribution and occurs in the western Mediterranean, in some parts of the eastern Mediterranean and in the neighboring Atlantic coasts such as those of Morocco.[8] It is available in Maldives, Lakshadweep and Rameshwaram in India.[9]

Figure 1: Raw coral

Zoological classification

Kingdom	-	Animalia
Subkingdom	-	Radiata
Phylum	-	Cnidarians
Subphylum	-	Anthozoa
Class	-	Anthozoa
Subclass	-	Octacorallia
Order	-	Alcyonaceae
Suborder	-	Scleraxonia
Family	-	Coralliidae
Genus	-	Corallium
Species	-	*Corallium rubrum* (Linnaeus 1758)[10]

Vernacular names

English: Sardinia coral
Hindi: Parvara, Munga
Tamil: Pavalam
Bengali: Pravala
Kannada: Havala
Telugu: Pagadamu
Punjabi: Marjan[11]

Habitat and Biology
A rocky bottom species inhabiting a wide depth range from 7-200 m depth, their shallowest depth range is in between 15 to 70 M growing in caves, crevices, overhangs and other protected interstices[12]. It is a slow growing (a few centimeters per year) and long living species[13].

Macroscopic characters
In appearance, it is a small shrub in a pendant or reverse position. It occurs in slender, cylindrical and generally branched pieces of brick red color. It is made up of numerous minute pieces; each piece is minutely and longitudinally furrowed. Its smell resembles frankincense. It easily breaks with crackling sound. In the raw state, the stems and branches are covered with a cortical substance which is the habitation of soft small polypi.[14]

Microscopic characters
A medullary zone surrounded by a circular domain made up of concentric rings can be seen through an axial view of the skeleton. These concentric rings are annual and exposed the cyclic variation of organic matter and Magnesium/Calcium ratio; thus, both organic matter and Magnesium Calcium ratio can be used to date red coral colonies. Growth rings display wavelets. The internal structure of each wavelet results from the stacking of layers with tortuous interfaces.[15]

Constituents
The skeleton of red coral is made primarily (85 % of the wet weight) of calcium carbonate in the form of calcite. It also includes 5 % of other elements such as Mg, Fe, So_4, P_2O_5, Sio_2, Pb, Zn[16] and an organic matrix.[17]

Review of Siddha Literature
Synonyms in Siddha
Vidhrumam, thukir, thuppu, pravalam, senthandu maalai, varithi thandu[18]

It is one of the nine gems and kadalpadu thiraviyangal.[19] As per Hindupurana, the muscles of Valan fell down in the sea and became Pavalam during his battle with lord Indiran. Thiruvilayadal puranam explained how the coral should be identified by appearance. There are six good characters and six bad characters seen in Pavalam depend on its appearance.[20] As mentioned in Silapathigaram, the good coral should not be twisted, porosus and must possess bright red color. Thirumoolar compared Pavalam with 'Shakthi' (Lord Parvathy i.e. energy) and Sulphur (Shakthi beesam). He mentioned in his quotes

"Deviyurathai naer cheppalagum thuppai
yavi yirathane ragu maouthigam"

Action
Nervine tonic, diuretic, laxative, astringent[21] and antacid[22]

Parts used
The calcareous shell or skeleton

Common uses of Pavalam
Pavalam is used to treat fever, kaba diseases, tuberculosis, tastelessness, insect bites, spermatorrhoea, dyspepsia and dryness of mouth. It is also very much helpful in the management of azhal aggravated diseases, excessive phlegm and eye disorders. As per Siddha literature, every raw material should be purified before preparing as medicine[23]. This process is used to detoxify the raw material. The purification methods of Pavalam according to various Siddha literatures are given in Table 1.
The detoxified raw Pavalam is used to prepare parpam, chendooram and chunnams etc which are given as internal medicines.

Parpam
A variety of parpam preparations are mentioned in the literature by using Pavalam. A list of various plant juices used to prepare parpam are given in Table 2.
Next to parpam preparations, many chunnam preparations were found in the literature. Chendooram preparation are very minimal and the available preparations are also made with combination of other metals and minerals like Annabedi, (Blue viterol) Karuvangam (Lead), Abragam (Mica) etc. Dr. Thiyagarajan, the author of Siddha Materia Medica mentioned that the preparation of chendooram exclusively from Pavalam is very difficult[28]. Chunnam is considered as a medicament higher in efficacy than parpam and chendooram[29]. A variety of chunnam preparations are mentioned in the literature. Some of the main preparations are given in the Table 3.

Scientific validation
Based on the Siddha literature, the scientific works which were evaluated already were searched through internet. There were totally 8 studies done, out of which 6 studies were done in animals and 2 studies were done on humans. The preclinical studies were done to rule out its anti-osteoporotic, anti atherosclerotic, hepatoprotective and haemostatic activities. Two clinical trials were carried out in patients with hyperacidity and hepatitis.

***In vitro* Study**
Pavala parpam was evaluated for its antibacterial activity in five bacterial strains by using disc diffusion method. The results showed that Pavala parpam has good anti-microbial activity at the dilution of 25 µl/disc against the bacterial strains such as *S. mutans, s. aureus, E. coli, K. pneumonia and P. aeruginosa.*[30]

Preclinical study
Anti osteoporotic activity
The drug Pravala bhasma was evaluated for anti osteoporotic activity in experimental rats. Progressive bone loss was induced in Female Sprague-Dawley rats by ovariectomy followed by low calcium diet. The drug treated group received Pravala bhasma 65 mg/kg body weight, twice a day for 16 weeks. The level of calcium and phosphorus excreted in urine was comparatively decreased in the treated group. The decreased femoral weight and density were significantly reversed in animals treated with Pravala bhasma. The cortical bone morphometric indices also revealed raised medullary

width and cross-sectional area in treatment group. The combined cortical thickness and cortical and periosteal area ratio are also increased compared to sham operated animals. Scanning electron microscopy (SEM) study showed porous and erosive appearance of the distal femur at the epiphysis and reduced Ca/P ratio in ovariectomised animals was also reversed compared to SHAM and drug treated group.[31]

Anti atherosclerotic activity

The effect of orally administered Anna pavala chendooram, was investigated on experimental atherosclerosis. Rabbits were fed with a cholesterol rich (0.5 %) diet for 6 months to induce atherosclerosis. These animals were divided into various groups of treatment. The treated group was given 50 mg of Anna pavala chendooram/day/animal for a period of further 6 months. At the end of the experiment, plasma and aortic lipid components were estimated and the atherosclerotic lesions of the aorta were quantified by histological examination. Changes in the metabolism of plasma and aortic phospholipids were studied by fractionation into individual lipids following the incorporation of radiolabel from[14] C-acetate into phospholipids. The plasma cholesterol level was reduced up to 65 % and the HDL level was increased. The atheroma formation was also inhibited. Anna pavala chendooram reduced the plasma sphingomyelin levels[32,33].

Haemostatic activity

The drug Pavala parpam was evaluated for haemostatic activity in Swiss albino mice. In acute toxicity study, the drug was found to be safe up to 2000 mg/kg body weight in Swiss albino mice. The animals were treated with 500 mg/kg body weight /p.o. After the administration of Pavala Parpam the treated animals' blood showed marked reduction in both bleeding and clotting time when compared to untreated control animal's blood. There was also significant reduction in bleeding that was well comparable to that of standard adrenochrome, a haemostatic drug[34].

Hepato-protective activity

The acute and 28 days repeated oral toxicity studies on Kodi pavala chunnam was carried out as per OECD guidelines. In acute toxicity study it was found that Kodi pavala chunnam was found to be non toxic upto 4000 mg/kg. In repeated oral toxicity, except mild diarrhea, Kodi pavala chunnam did not exhibit any signs of intoxication in the animals. Kodi pavala chunnam was evaluated for its hepatoprotective activity in experimental rats. Liver damage was induced by CCl_4 in wistar rats. The liver damage was assessed by heamatological and biochemical parameters. The animals treated with Kodi Pavala Chunnam showed near normal levels in haematological, biochemical parameters which indicate the hepato-protective activity of Pavalam against CCl_4 induced liver damage.

Clinical trials

Pravala hasma in hyperacidity patients

Two samples of Pravala Mula bhasma (Bhasma prepared from *Tubiphora musica*) and two samples of Pravala Shakha bhasma (bhasma prepared from *Corallium rubrum*) were prepared and studied in patients with hyperacidity (Amlapitta) for a period of 21 days. The cardinal and associated symptoms were carefully noticed and scored. Results of the study suggested that the effect of Pravala Shakha bhasma was better than that of Pravala mula bhasma.[37]

Kodipavala chunnam in hepatitis patients

The drug Kodipavala chunnam was evaluated for hepatoprotective activity in patients with infective hepatitis, drug induced hepatitis and alcoholic hepatitis. The drug was given to the patients at the dose of 100 to 200 mg thrice daily with honey for a period of 28 days. The levels of serum bilirubin, ALP, AST, SAP and GGT were monitored before and after the treatment. It was noticed that the elevated biochemical parameters of liver were restored to normal levels with the usage of Kodipavala chunnam.[38]

CONCLUSION

The literature search in Siddha classical texts revealed that Pavalam plays a major role in the management of diseases like diabetes, bronchial asthma, tuberculosis, hepatitis and bleeding disorders. The toxicity studies done on Pavala parpam and Kodipavala chunnam prove that the internal administration of the drug is safe up to 2000 mg/kg and 4000 mg/kg body weight respectively. The scientific validations which were done on Pavalam proved its the traditional claim. At the same time, the clinical trials which were conducted in a small size of patients were not adequate and the animal studies are only preliminary studies. Further studies are required to explore the genotoxicity, pharmacokinetics and well randomized control trials to strengthen the traditional claim. This review justifies the continuous use of Pavalam in Siddha system of medicine for various ailments.

Table 1: Purification methods of Pavalam

No		Material used	Reference
1.		Date's arrack	Theran yamaga venba[24]
2.		Lemon juice	Gunapadam thathu jeeva vaguppu [25]
3.		Cow's Butter milk	Pathinen Siddhar Sillarai Vaidhya kovai[26]
4.		Kattralai juice	Anuboga vaidhya navaneetham part III[27]

Table 2: Plants useful to prepare Pavala parpam

Name	Part used	Botanical name	Indication
Thiruvathi* Kondrai* Vengai* Velerukku* *Theran method of preparation	Leaf Whole plant Whole plant Whole plant	*Bauhinia tomentosa* *Cassia fistula* *Pterocarpus marsupium* *Calotropis gigantea*	Hemiplegia, Bronchial asthma, Ascites Diabetes, Nervous weakness
Ilanthai	Leaf	*Zizyphus jujuba*	Dry cough, Dysentry Dysuria, Spermatorrhoea
Thaivelai	Leaf	*Gynandropsis pentaphylla*	Dry cough
Keezhanelli	Whole plant	*Phyllanthus amarus*	Bronchial asthma, Osteomyelitis, Dysuria, Stomach pain
Pirandai	Leaf	*Cisus quandrangularis*	Tuberculosis, Diabetes, Dysuria
Puliyarai	Leaf	*Oxalis corniculata*	Tuberculosis, Diabetes
Erukku	Latex	*Calotropis indica*	Cough, Tuberculosis, Syphilis
Thanneer vittan	Root tuber	*Asparagus racemosus*	Bleeding disorders
Thelkodukku	Leaf	*Heliotropium indicum*	Bronchial asthma, Primary complex
Roja	Leaf	*Rosa damescena*	Spermatorrhoea
Vaalai	Stem	*Musa paradisiaca*	Bleeding disorders
Sotrukattralai	Leaf	*Aloe vera*	Spleenomegaly, Tuberculosis, cough
Madhulai Vembu Maruthondri	Leaf Leaf Leaf	*Punica granatum* *Azaridacta indica* *Lawsonia inermis*	Haemoptysis, Haemetemesis, Epistaxis, Malena
Rabbits blood	---	----	Cough, Tuberculosis
Honey	---	----	Venereal diseases
Sugar candy	---	----	Blood in urine, Epistaxis, Bloody diarrhea, Any bleeding from internal organs, Blood purifier

Table 3: Various chunnam preparations mentioned in Siddha literature

Name of the preparation	Book	Indication
Kodipavala chunnam (5 different preparations using different plant juices)	The pharmacopoeia of Siddha research medicines	Gonorrhoea, Leucorrhoea, Burning of heat, Hepatitis, Rickets, Bronchial asthma, Skin diseases
Pavala veera chunnam	The pharmacopoeia of Siddha research medicines	Cholelithiasis, Biliary colic, Cough, Bronchial asthma, Tuberculosis
Narpavala chunnam	The pharmacopoeia of Siddha research medicines	Bronchial asthma, Cough, Hepatitis, Rickets, Tuberculosis
Thiruvanga chunnam	The pharmacopoeia of Siddha research medicines	Diabetes, Gonorrhoea, Cancer cervix, Ascites
Pavala chunnam	Bogar karukkadai nigandu 500	Bronchial asthma, Relieves stress, Spermatorrhoea
Kodipavala chunnam	Anuboga vaithya navaneetham Part III	Cough, Bronchial asthma, Tuberculosis

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