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Review Article

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Potential Anti-oxidant activity of Siddha Medicinal Herbs and Formulations - A Review Article

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Abstract

Antioxidants can slow down the process of oxidative damage throughout the body. In general an anti oxidant is nothing but a molecule that inhibits the oxidation of other molecules. Vitamin E, C, Selenium and carotenoids such as beta carotene, lycopene and lutein are some of the anti oxidants which are present in our dietary and herbal sources. The present study is aimed to review the antioxidant effect of Siddha medicinal herbs and Siddha formulations as well as its pharmacological researches on antioxidant potential. The main objective of the study is to create awareness about the importance of herbs which are using in our day to day life and other herbs which has to be used further. It also provides the proper way of consuming the herbs in order to prevent various life style disorders.

Keywords: Anti - oxidant herbs, Siddha medicine, herbal formulation.

Introduction

During various metabolic processes in the body and due to various environmental and chemical factors the oxidative stress is produced in our body. It generates reactive free radicals and damages the four basic molecules for building life such as carbohydrates, lipids, proteins and nucleic acids[1]. At even smaller concentration, the anti oxidants can inhibit the process of oxidation[2]. Nowadays, the need of natural anti oxidants seems to be increasing instead of synthetic anti oxidants, such as Butylated Hydroxyl Anisole (BHA), Butylated Hydroxy Toluene (BHT), Tertiary Butyl Hydro Quinone (TBHQ)[3]. Natural antioxidants helps in preventing the lifestyle diseases like cancer, diabetes and heart diseases[4].Other than vitamins there are rich sources of anti oxidants present in many medicinal plants[5].

The herbs are playing major role in Siddha system for preparing the medicine and treating the diseases. In Siddha system, *Kayakarpam* medicines is used not only to treat ailments but also used to postpond the ageing process , which contains rich antioxidants. The anti oxidants or *Kayakarpam* medicines plays a vital role in the treatment of challenging disease. The *kayakarpam* medicines prevents age related changes like wrinkling of skin, greying and prevents the mankind from atherosclerosis, cardiovascular disease, cancer, arthritis, cataracts, osteoporosis, type 2 diabetes, hypertension and Alzheimer's disease. Sage *Thirumoolar* in *Tirumantiram* revealed that *Kaya karpam* medicines makes the body as strong as stone and make it enduring. *Karpam* may be classified into general and special. The general and the special *karpa* medicines

may be further grouped into three categories based on their origin such as medicines of herbal origin, mineral and metal origin, animal origin. The Siddha classical text *Theran Yamaga Venba* and *Karuvoorar Vatha Kaviyam* explains about the *Karpa* medicines of herbal origin. Sage *Karuvoorar* listed 108 herbs as *kayakarpa* medicinal herbs which has been mentioned in the text *Vadhakaviyam.* One of our Siddhar sage *Theran* highlighted some herbs like *Zingiber officinale*, *Aloe barbadensis, Eclipta alba, Azadirachta indica*, *Terminalia chebula*, *Solanum trilobatum*, *Acalypha indica*, *Aegle marmelos, Vitex negundo* as a potent anti oxidant herb and explained about its therapeutic effect for specific disease[6].

Materials and Methods

In Siddha system, many more herbs and herbal formulations are used for the purpose of anti oxidant, these herbs are known as *kayakarpa mooligaikal* (anti oxidant herbs). The names of the anti oxidant herbs, part used, phytochemicals, anti oxidant effect are listed in table number: 1.

Kuppaimeni (*Acalypha indica*)

It is a annual herb with broadly ovate leaves. In Siddha system of medicine, the leaves are given in the treatment of cuts and wounds, loss of appetite, painful rheumatic afflictions and also acts as a mild purgative[9]. In Siddha, the whole plant of *Acalypha indica* is advised to consume for 48 days as cooked and fried form with castor oil. It cures all diseases caused by derangement of *Kabham* and *Vatham* and also helps to improves general health.[6,7,8]

Vilvam (*Aegle marmelos*)

It is a deciduous, spinous aromatic tree. The leaves are given in the treatment of diabetes and jaundice. Seeds possesses anti allergic and schizontocidal activity[9]. Prepare food dish, pickle, decoction and medicated oil from the unripe fruits, leaves and root of *Aegle marmelos*. It can be given for incoherent speech (due to fainting) and also gives good complexion and improves spermatogenesis. [6,7,8]

Katralai (*Aloe barbadensis*)

Aloe is a stem-less or very short stemmed plant. Aloe gel showed strong haemagglutinating and mitogenic activity. It also inhibits growth of human cancer cells, cures gingivitis, reverses the degenerative skin changes due to aging and helps in skin regeneration[9]. Pickles of *Aloe barbadensis* or its dry part can be taken. It retains our youthfulness and allows us to live for the full span of our life i.e hundred years. [6,7,8]

Ponnankani (*Alternanthera sessilis*)

It is an aquatic, perennial herb. The leaves act as protective agent against Cancer and seed shows anti bacterial activity[9]. Take fresh leaves of *Alternanthera sessilis* and fry with ghee. Add pepper and salt and consume for 48 days regularly. It gives good complexion and beauty, promotes eyesight and improves longevity of the life. [6,7,8]

Nilavembu (Andrographis paniculata)

It is an erect annual herb. The plant shows anti pyretic, anti thrombogenic and anti hepatotoxic activities [9].The leaves and stem of *Andrographis paniculata* are used in the treatment of sinusitis, fever and delusion. The leaf extract especially cures diarrhea in children.[7,8]

Thaneervitttan (*Asparagus racemosus*)

It is a woody perennial climber. The plant acts as demulcent, diuretic, aphrodisiac, galactogogue, and immune modulator. The root can be given for nervous disorders[9]. The stem tuber of *Asparagus racemosus* has potential effect to cure leucorrhoea, chronic fever, hemolytic disorders, diabetes mellitus. It can be administered at the dose level of 1 to 8 grams twice a day.[7, 8]

Vembu (*Azadirachta indica*)

It is a fast growing tree. The root bark exhibited antitumour, antibiotic and insecticidal properties. The leaves shows antifertility, anthelmintic and nematicidal activity [9].Powder the tender and mature leaves of *Azadirachta indica* ,to this add half the quantity of Ajwain and salt, grind it well and consume it. It can be used to treat cataract, night blindness and jaundice. [6, 7, 8]

Brammi (*Bacopa monnieri*)

It is a perennial, creeping herb. It causes prolonged elevated level of cerebral glutamic acid and a transient increase in GABA level which helps in the process of learning. It also shows anti epileptic and anti cancer activities[9]. The leaves of *Bacopa monnieri* can be used as diuretics, laxative and nervine tonic. It is also used in ghee form for best results.[7, 8]

Elumitchai (*Citrus limon*)

It is a small evergreen tree with stout, stiff thorns. The fresh juice is used in the treatment of skin problems like leprosy, white spots. The peel possesses insect repellent property and used as hair rinse and mouth freshener [9].The juice and pickle preparation of *Citrus limon* can be taken for weakness of the body, greying of hair, tremor, bewilderment, ascites, pleurisy, ankylosis of the joints and some kinds of manic disorders. [6, 7, 8]

Seeragam (*Cuminum cyminum*)

It is a small annual plant with a slender, branched stem. The seed show aphrodisiac property and stimulates cytochrome P and b_5 and N-demethylase activity [9].Consume the powder of *Cuminum cyminum* seeds with equal quantity of sugar for angioedema. It strengthens the body and also cures indigestion. It acts as stomachic. [6, 7, 8]

Manjal (Curcuma longa)

It is a rhizomatous herbaceous erect perennial plant. It acts as stomachic, tonic, blood purifier, anthelmintic, carminative, antacid and antiperiodic. It is used in the treatment of fever, urinary tract infections, gastritis, bronchitis and asthma. Externally it is used to cure chicken pox eruptions, bruises, sprains, indolent ulcers and skin problems such as prurigo, ringworm, scabies and eczema [9]. The rhizome of *Curcuma longa* is used in the treatment of disorders caused by all three humours in human system, headache, vomiting, sinusitis, rhinitis, leucorrhoea, oedema and ulcers. It also acts as hepatoprotective. It can be administered at the dose level of 520-650 mg.[7, 8]

Arugampul (*Cynodon dactylon*)

It is a slender stoloniferous creeping perennial. It has significant role in treating biliousness, vomiting, hallucinations, menorrhagia, leucorrhoea, chronic diarrhea, dysentery, retention of urine, epistaxis, leprosy and other skin diseases [9]. Grass of *Cynodon dactylon* cures eye disorders, hypertension and toxicity of drugs. The extract can be used along with milk.[7, 8]

Korai kilangu (*Cyperus rotundus*)

It is a smooth, slender, erect perennial plant. The tubers acts as carminative, stomachic, emmenagogue, diuretic, anthelmintic, stimulant, anti inflammatory. It has excellent anti rheumatic activity and shows eight times more effective activity than hydrocortisone. It is used in the treatment of obesity, hypertension and arthritis [9]. Take *Cyperus rotundus* and made into flour. Add adequate amount of sugar and mixed well. This mixture can be given for tuberculosis and all phlegmatic diseases (disease caused by *kabham*) . [6, 7, 8]

Karisalai (*Eclipta alba*)

It is an erect, creeping perennial herb. It exhibits hepato-protective activity and used in the management of viral hepatitis. It also possesses anti oxidant, antiulcerogenic, anti dote, adaptogenic, immune- stimulatory, hypotensive, anti asthmatic properties [9]. The powder form of whole plant of *Eclipta alba* can be taken with tender coconut water and honey for 2 months and one month respectively. It prevents grey hair and wrinkling of skin. [6, 7, 8]

Elam (*Elettaria cardamomum*)

It is a large herbaceous perennial plant. It acts as bacteriostatic and emetic agents [9].Take *Elettaria cardamomum* seeds, pepper and cumin seeds each 1gm,3/4gm and ½ gm respectively. Add 3 measures of the perfume zibeth obtained from the pouch of civet cat and 2 measures of the cow's ghee, to the total weight of the above ingredients. Mix them well. Drench a cotton piece with this mixture and use it as snuff four times a day for sinusitis with epistaxis. [6, 7, 8]

Nelli (*Embilica officinalis*)

It is a deciduous tree with edible fruit. The fruit showed potent inhibitory activity against HIV -1-RT. It also possesses hypoglycemic, anti oxidant, hepato protective, anti ulcerogenic, anti secretory, anti carcinogenic and anti mutagenic activities. Leaves can be used in dysentery and diabetes [9]. Take *Embilica officinalis* root, seed, bark, leaves, unripe and ripen fruit. Prepare pickle or ground dish or decoction and or juice. It cures spleenomegaly, menorrhagia, anaemia, haemorrhoids, ascites due to liver diseases, and syncope. [6, 7, 8]

Nannaari (*Hemidesmus indicus*)

It is a perennial twining shrub. The roots showed anti venom, hemorrhagic and anti coagulant activities[9].The whole plant of Hemidesmus indicus can be fried in ghee and made into 'chutney' or 'seasoning balls'. Tamarind, pepper and salt can be added as required quantity. Mustard seeds is to be avoided. It can be given for 48 days. It is indicated for the osmidrosis especially in axillary region caused by burning sensation due to venereal disease. [6, 7, 8]

Avuri (*Indigofera tinctoria*)

It is a branching shrub. The plant is used in the treatment of hydrophobia, blennorrhagia, epilepsy and nervous disorders. It has anti cancer property and also used as dying agent [9].The leaves and roots of *Indigofera tinctoria* can detoxify all types of poisonous substances. Leaves can be used to cure jaundice, indigestion, and osteoarthritis and gives glitter to the skin. It can be administered in decoction form.[7, 8]

Nunaa (*Morinda tinctoria*)

It is an evergreen shrub. The root bark is mainly used as dying agent [9]. Bark of *Morinda tinctoria* can be used to cure eczema, ulcerous wound, tumours. Leaf extract can cure indigestion, venereal disease and gives lustre.[7, 8]

Thulasi (*Ocimum sanctum*)

It is an erect, branched, aromatic plant. The plant shows anti tubercular and insecticidal activities. The leaves

possesses stimulating, expectorant, stomachic, diaphoretic and anti periodic properties [9]. Take *Ocimum sanctum* leaves or roots and or juice extract. Boil it with gingely oil. Use this medicated oil for head bath. It will cure phlegmatic (*kabha*) diseases and diseases caused by combination of wind and bile humours. [6, 7, 8]

Keezhanelli (*Phyllanthus amarus*)

It is a branching annual glabrous herb. The plant shows potential hepatoprotective, diuretic, hypotensive, hypoglycemic properties [9]. Grind the whole plant of *Phyllanthus amarus* with cow's curd and consume it daily. It cures venereal diseases. [6, 7, 8]

Thippili (*Piper longum*)

It is a slender aromatic climber. The fruits acts as carminative, sedative, general tonic, hematinic, cholagogue, emmenagogue, anthelmintic and acts as counter irritant and analgesic when applied externally [9]. Dried fruit of *Piper longum* is used to cure all phlegmatic diseases (*kabha*) like bronchitis, asthma and other diseases like anemia, tastelessness, ulcers, headache, sinusitis, some ENT disorders. The powder form can be taken along with honey for one month. It can be used to treat discolored spots or patches in the skin.[7,8]

Serankottai (*Semecarpus anacardium*)

It is a moderate sized deciduous tree. The nut shows anti bacterial and anti cancerous activity. Mainly its used in the treatment of oesophagal and mouth cancers, sciatica [9]. The ghee or powder preparation of *Semecarpus anacardium* can be given in the treatment of paraplegia for 48 days. [6, 7, 8]

Thoothuvalai (*Solanum trilobatum*)

It is a much branched spiny scandent climbing shrub. The berries and flowers are used in the treatment of cough and chronic bronchitis [9]. Dried or pickle preparation or the cooked preparation of *Solanum trilobatum* with ghee can be given for 48 days. It helps to cure eye diseases. [6, 7, 8]

Thalisa pathri (*Taxus baccata*)

It is a moderate sized evergreen non resinous tree. It exhibits potent anti oxidant and anti cancer properties [9]. The leaves of *Taxus baccata* can be used for diarrhea, fever, chronic cough, dyspnea, indigestion and vomiting.[7,8]

Kadukkai (*Terminalia chebula*)

It is a moderate sized tree. The leaves shows strong anti fungal activity and cytotoxicity in melanoma tumour cells. The fruit possesses anti bacterial, antifungal, anti viral, hypotensive, hepatoprotective activities[9]. Consuming the powder of *Terminalia chebula* with pure water in every day at evening time can prevent jaundice and ascitis. [6, 7, 8]

Seenthil (*Tinospora cordifolia*)

It is a large deciduous, glabrous, succulent climbing shrub. The plant extract acts as immunomodulator in obstructive jaundice, hepatic fibrosis, peritonitis and sepsis. It also reduces the level of bilirubin and alkaline phosphatase level and prevent fibrotic changes and enhance liver tissue regeneration [9].Stem tuber of *Tinospora cordifolia* used for hypertension, fever, indigestion, diarrhea, and detoxifies the body. It can be taken in the form of powder, decoction and or ghee.[7, 8]

Manjal karisalai (*Wedelia calendulaceae*)

It is a procumbent perennial herb. It shows significant hepatoprotective, nematicidal and wound healing activity. It is generally used as a tonic for hepatic and spleen enlargement [9]. The leaves of *Wedelia calendulaceae* improves skin tone, eye vision and gives high intellect. It cures abdominal tumours.[7, 8]

Amukkura (*Withania somnifera*)

It is an erect, branched evergreen tomentose shrub. It possesses aphrodisiac, anti tumour, tranquilizer, adaptogenic, anti inflammatory, anti depressant and anti epileptic properties [9].Take tuber of *Withania somnifera* and make it as powder or ghee and consume it. It improves spermatogenesis and gives longevity. [6, 7, 8]

Inji /chukku (*Zingiber officinale*)

It is a rhizomatous perennial herb. The dried ginger shows anti ulcer activity [9]. Soak pieces of fresh *Zingiber officinale* in honey and consume it. It prevents ageing and other geriatric disorders. It also improves eye vision. [6, 7, 8]

Siddha formulations

In Siddha system of medicine some preparations are having antioxidant activity and used for longevity. Few preparations are listed here.

Triphala Chooranam

It's a poly herbal Siddha preparation. It has anti ulcer, anti mutagenic anti diabetic, anti inflammatory & anti bacterial activities and acts as free radical scavengers, cytotoxic and apoptotic agent. *Triphala Chooranam* 1-3grams twice or thrice a day can be administered along with honey, ghee or warm water for constipation, cough, eye diseases and stomatitis.[40]

Table- 1. Detailed description about *In-vitro* and *In-vivo* study on the above medicinal herbs and Siddha formulations.

s.no	Botanical Name	Siddha/ Tamil name	Family name	Parts used	Active chemical constituents	Assay used for Anti Oxidant activity	Pharmacological View
1	*Acalypha indica*	*Kuppai meni*	Euphorbiaceae	Aerial Part	Tannins, Pyranoquinolinone Alkaloid, Kaempferol Glycosides, Cyanogenic Glucoside, Acalyphine, Acalyphamides	DPPH radical scavenging assay	Hexane, chloroform, and methanol extracts showed significant antioxidant activities with an IC50 of 6.19 ± 0.010, 5.70 ± 0.050, and 7.79 ± 0.020 mg/mL, respectively
						ABTS radical scavenging assay	Hexane, chloroform, and methanol extracts showed significant antioxidant activity with the IC50 of 6.13 ± 0.010, 6.31 ± 0.020, and 6.37 ± 0.020 mg/mL, respectively[10]
2	*Aegle marmelos*	*Vilvam*	Rutaceae	Fruit Pulp	Aegeline, Aegelinine, Marmin, Marmesin, Marmesinin, Rutin, Marmeloside, Lignin, Fat and Oil	DPPH radical scavenging assay	Aqueous and alcoholic extracts showed significant antioxidant activity with the IC50 of 92.648±30.368, 106.158±25.332, whereas ascorbic acid showed 63.997±25.244 µg/mL, respectively
						ABTS radical scavenging assay	Aqueous and alcoholic extracts showed significant antioxidant activity with the IC50 of 37.11±13.50, 35.02±19.16, whereas ascorbic acid showed 16.575±8.10 µg/mL, respectively
						Reducing power assay	Aqueous and alcoholic extracts showed significant antioxidant activity with the IC50 of 158.995±59.463, 283.0678±135.801,whereas ascorbic acid showed 34.627±9.377 µg/mL, respectively
						Nitric oxide radical scavenging assay	Aqueous and alcoholic extracts showed significant antioxidant activity with the IC50 of 98.680±40.238, 106.243±31.651, whereas ascorbic acid showed

							47.899±30.195 µg/mL, respectively
						Superoxide radical scavenging assay H_2O_2 method	Aqueous and alcoholic extracts showed significant antioxidant activity with the IC50 of 91.410±17.365, 147.85±44.86, whereas ascorbic acid showed 21.192±9.36 µg/mL, respectively[11]
3	*Aloe barbadensis*	*Katraalai*	Liliaceae	Crude Gel	Phenolics, Aloecelin, Aloin, Emodin, Saccharides, Vitamins, Enzymes	DPPH radical scavenging assay	Plant extract showed 17.11 ± 1.30 % inhibitions whereas Ascorbic acid (400 µg/mL) as control showed 81.78 ± 0.24% inhibition.
						Nitric Oxide Radical Scavenging Assay	Plant extract showed 34.88 ± 0.52 % inhibition whereas ascorbic acid (2mg/mL) as control showed 87.25 ± 0.74% inhibition.
						Xanthine oxidase inhibitory assay	Plant extract showed 73.85 ± 2.02 % inhibition whereas allopurinol (100 µg/mL) as control showed85.94 ± 0.11 % inhibition
						Antioxidant activity of the exudate from Aloe barbadensis leaves in diabetic rats	There was a slight increase in body weight and a significant decrease in fasting blood glucose in diabetic rats.[12]
4	*Alternanthra sessilis*	*Ponnankanni*	Amaranthaceae	Leaves	β Sitosterol, Camperterol, α and β spinasterol, Stigmasterol, Lupeol, Saponins	Dot Plot Assay DPPH free radical Activity	It showed the DPPH scavenging activity in aqueous extract, followed by ethanol and methanol extract
						DPPH Photometric Assay	Methanol, ethanol and Aqueous Extracts showed 33.44, 48.30, 68.04 % inhibition, respectively.[13]
5	*Andrographis paniculata*	*Nilavembu*	Acanthaceae	Whole Plant	Andrographolides, Diterpenoids, Flavonoids and Polyphenols	Nitric oxide scavenging activity	The methanol extract showed highest nitric oxide scavenging activity followed by distilled water extract and chloroform

						Hydroxyl Radical Scavenging Activity	Methanol and distilled extracts showed highest % of inhibition at 2µg/ml
						Reducing Power Assay	Chloroform extract showed highest reducing power assay at 6µg/ml and methanol extract showed at 4µg/ml.[14]
6	*Asparagus racemosus*	*Thaneervitttan*	Liliaceae	Roots	Shatavarin I-IV, Diosgenin, Isoflavones, Polysaccharides, Asparagenin A, Racemosol, Shatavaroside A&B, Steroidal Saponins, Essential Fatty Acids	DPPH radical scavenging activity	Methanol extract showed an IC50 value of 4158.8 whereas butylated hydroxytoluene used as a standard showed an IC50 of 46.25µg.[15]
7	*Azadirachta indica*	*Vembu*	Meliaceae	Leaves	Azadirachtin, Nimbolide, Nimbin, Nimbidin, Nimbolinin, Margolone.	DPPH radical scavenging assay	50% ethanolic extract showed significant free radical scavenging activity with an IC50 of 110.36µg/ml.[16]
8	*Bacopa monnieri*	*Brammi*	Scrophulariaceae	Whole Plant	Bacoside A & B, Betullic Acid, Betulinic Acid, Luteolin, D-Mannitol, Monnierin	DPPH Scavenging Activity	Methanol extract showed an IC50 value of 457.09 µg/mL whereas ascorbic acid used as a standard showed the value of 14.45 µg/mL
						Total Reducing Power Determination	Methanol extract showed an IC50 value of 59.32±0.068 µg/mL Whereas ascorbic acid, quercetin and gallic acid, showed the value of 73.699, 290.14,218.082 µg/mL, respectively.
9	*Citrus limon*	*Elumitchai*	Rutaceae	Fruit	Quercetin, Myricitin, Rutin, Tangeritin, Naringin, Hesperidin, Ascorbic Acid, Pectin, Fibers, and Potassium Salt	Scavenging of hydrogen peroxide	The plant extract showed an IC50 value of 1.418mcg/ml whereas ascorbic acid showed 0.766µg/ml.
						Reducing power assay method	The plant extract showed an IC50 value of3.48 µg /ml whereas ascorbic acid showed1.87µg/ml.[18]

10	*Cuminum cyminum*	*Seeragam*	Apiaceae	Seeds	Cuminol, Cuminaldehyde, Safranal, Volatile Oil.	Lipoxygenase dependent lipid peroxidation system	Methanol extract an IC50 value of 1.72 ± 0.02µg/mL
						DPPH radical scavenging system	Methanol extract showed an IC50 value of 0.52 ± 0.01µg/mL
						Rat liver microsomal lipid peroxidation system	Methanol extract showed an IC50 value of 0.16 ± 0.30µg/mL.[19]
11	*Curcuma longa*	Manjal	Zingiberaceae	Rhizomes	Curcumin, Terpene Curcuminoids, , Essential Oils	DPPH free radical scavenging assay	Crude extract showed an IC50 value of200 µg, whereas ascorbic acid showed102 µg.[20]
12	*Cynodon dactylon*	*Arugampul*	Poaceae	Dried Grass	Arundoin, Furfural, Apigenin, Orientin, Vitexin, Luteolin, Phytol, Hexadeconoic Acid, β Carotene, β Sitosterol	DPPH radical scavenging assay	Ethanolic extract exhibited IC50 values of 72.43±4.46 whereas Ascorbic acid and Rutin showed 30.18±2.54, 16.44±2.10,respectively.
						Nitric oxide radical scavenging activity	Ethanolic extract exhibited IC50 values of 68.52±3.82 whereas Ascorbic acid and Rutin showed 41.72±3.39, 48.27±3.76, respectively.[21]
13	*Cyperus rotundus*	*Korai kilangu*	Cyperaceae	Rhizomes	Cyperene, Humulen, Selinene, Zierone, Pinene, Limonene, Copaene, Longiverbenone.	Superoxide anion scavenging activity assay	Ethanol extract showed an IC50 value of 0.031 mg mL^{-1}
						Hydroxyl radical scavenging activity assay	Ethanol extract showed an IC50 value of0.021 mg mL^{-1}
						Nitric oxide scavenging activity assay	Ethanol extract showed an IC50 value of 0.428 mg mL^{-1}
						Hydrogen peroxide scavenging activity assay	Ethanol extract showed an IC50 value of 1.642 mg mL^{-1}
						Metal chelating activity assay	Ethanol extract showed an IC50 value of0.192 mg mL^{-1}

						Reducing power assay	High absorbance at 700 nm Indicates high reducing power.
						Lipid peroxidation inhibition assay	Addition of 0.01-1.0 mg mL^{-1} of Ethanol extract to rat brain mitochondria significantly reduced MDA formation in a dose dependent manner.[22]
14	*Eclipta alba*	*Karisalai*	Asteraceae	Whole Plant	Ecliptine, Nicotine, Wedelolactone, Luteolin, A-Ter-Thienylmethanol, Stigmaesterol, βAmyrin, Ecliptasaponin, Zinc, Copper, Iron	Superoxide radical scavenging assay	Hydro-alcoholic extract showed an IC50 value of 150µg/mL.
						Hydroxyl radical scavenging assay	Hydro-alcoholic extract showed an IC50 value of 30 µg/ml.
						Nitrous oxide radical scavenging assay	Hydro-alcoholic extract showed an IC50 value of 50 µg/ml.
						DPPH radical scavenging assay	Hydro-alcoholic extract showed an IC50 value of 50 µg/ml.
						Reducing ability Fe+2 chelating ability	Hydro-alcoholic extract showed an IC50 value of 100 µg/ml.[23]
15	*Elettaria cardamomum*	*Elam*	Zingiberaceae	Seeds	αterpinyl acetate, Cineole, Linalyl Acetate, Limonene, Linalool, Myrcene, Magnesium, Iron, Copper, Zinc	DPPH radical scavenging assay	Ethanol extract showed 37.53 ± 5.274 % anti oxidant activity.[24]
16	*Emblica officinalis*	*Nelli*	Euphorbiaceae	Leaves	Emblicanin A & B, Puniglucanin, Pedunculagin, Glutamic Acid, Vitamin C, Proline, Aspartic Acid, Alanine, Lysine, Ellagic Acid.	DPPH radical scavenging activity	Hydro-methanolic extract showed an IC50 value of 45.38 µg/mlwhereas Ascorbic acid showed 40.24 µg/ml.
						Hydrogen peroxide scavenging activity assay	Hydro-methanolic extract showed an IC50 value of42.87 µg/mlwhereas Ascorbic acid showed34.51 µg/ml.
						Total Reductive Potential	Hydro-methanolic extract at dose 100 µg/ml had maximum reductive potential as measured by ferric ion reduction.[25]

17	*Hemidesmus indicus*	*Nannaari*	Asclepediaceae	Whole Plant	Sarsaponin, Smilacin, P-Methoxy Salicylic Aldehyde, β sitosterol, Sasapogenin, Stigmasterol Fatty Acids, Tannins.	Hydroxyl radical scavenging activity	Aqueous extract showed an IC50 value of 105µg/ml, whereas standard ascorbate showed 370µg/ml.
						Nitric oxide radical scavenging activity	Aqueous extract showed an IC50 value of 575µg/ml, whereas standard ascorbate showed 370µg/ml.
						Iron chelating activity	Aqueous extract showed an IC50 value of 95µg/ml, whereas standard ascorbate showed 130µg/ml.
						FRAP Assay	Aqueous extract showed an IC50 value of 160µg/ml, whereas standard ascorbate showed 370µg/ml.[26]
18	*Indigofera tinctoria*	*Avuri*	Fabaceae	Leaves	Indirubin, Indican Glucoside, Indigotin, Rotenoids, Terpinoids, Indigotine	DPPH radical scavenging assay	The crude leaf extract showed an IC50 valueof 51.66µg/ml.[27]
19	*Morinda Tinctoria*	*Nunaa*	Rubiaceae	Leaves	D-galactosamine, Morindin, Morindone, Saponin, Steroids	DPPH Radical Scavenging assay	Hexane, ethyl acetate, chloroform, and methanol extracts showed an IC50 value of100 µg/ml, 80 µg/ml, 90 µg/ml and 95µg/ml, respectively.
						Nitric oxide scavenging assay	Hexane, ethyl acetate, chloroform, and methanol extracts showed 13.9±0.003%; 13.7±0.006%; 10.8±0.004% and 15.4±0.024% inhibition, respectively at maximum concentration of 100 µg/ml.
						Phosphomolybdenum reducing power assay	Hexane, ethyl acetate, chloroform, and methanol extracts showed 0.565±0.07, 0.611±0.02, 0.608±0.042 and 0.59±0.056 absorbance at 700 nm.[28]
20	*Ocimum sanctum*	*Thulasi*	Lamiaceae	Whole Plant	Eugenol, Methyl Eugenol, Carvacrol, Cirsilineol, Circimaritin, Apigenin, Rosameric Acid, Caryophyllene, Essential Oils.	DPPH radical scavenging effect	Crude plant extracts showed an IC50 value of 34.21µg/mL whereas standard ascorbic acid showed18.69 µg/mL.
						Nitric oxide radical scavenging effect	Crude plant extracts showed an IC50 value of86.91 µg/mLwhereas curcuminshowed58.11 µg/mL.

						Superoxide anion radical scavenging effect	Crude plant extracts showed an IC50 value of73.38 µg/mL whereas curcumin showed24.67 µg/mL.
						Hydroxyl radical scavenging effect	Crude plant extracts showed an IC50 value of 42.69 µg/mL whereas Catechin showed17.71µg/mL.[29]
21	*Phyllanthus amarus*	*Keezhanelli*	Euphorbiaceae	Whole Plant	Isobubbialine, Epibubbialine, Phyllanthin, Niranthin, Nirtetralin, Tannins, Ellagitannins, Lignans, Rutin, Linalool, Phytol.	In vivo effect of aqueous extract of Phyllanthusamarus against H_2O_2 induced lymphocyte DNA damage	A significant protection against H_2O_2 induced DNA damage was observed in the lymphocytes of *Phyllanthus amarus* treated rats compared to normal rats (85.3% decrease in number of damaged cells and 75.4% decrease in tail length of comets).
						Effect of plant extract against in vitro oxidative stress caused by nitric oxide generating system/ STZ	*Phyllanthus amarus* pretreated lymphocytes showed decrease in the number of damaged cells (89.2% and 91.1%) and length of comets (72.4% and 77.3%) against STZ and NO induced DNA damage respectively.[30]
22	*Piper longum*	*Thippili*	Piperaceae	*Seeds*	Piperine, Rutin, Piperamine, Pinene, Chavicine, Chavicol, Linalool, Limonene.	DPPH radical scavenging activity	Chloroform extract showed an IC50 value of 6 µg/mL.
						Nitric Oxide scavenging activity	Chloroform extract showed an IC50 value of 76 µg/mL
						Hydroxy radical scavenging activity	Chloroform extract showed an IC50 value of 34µg/mL
						Reductive ability assay	Chloroform extract exhibited higher reductive ability as compared to other extracts.
						ABTS radical scavenging activity	Chloroform extract showed an IC50 value of 30µg/mL.[31]
23	*Semecarpus*	*Serankottai*	Anacardiaceae	Stem Bark	Anarcardic Acid,	Lipid peroxidation	Hexane, chloroform, ethyl acetate

	anacardium				Anacardol, Cardol, Semecarpol, Bhilawanol A& B, Biflavanoids, Anacardoside.		and methanol extracts showed an IC50 value of 205.08±14.45,187.43±11.43,102.34 ±9.67 and 165.21±9.82 whereas curcumin used as standard showed 10±1.13µg/ml, respectively.
						Free radical scavenging activity (DPPH)	Hexane, chloroform, ethyl acetate and methanol extracts showed an IC50 value of 103.69±9.98,82.45±7.77,44.03±4.12 , and 60.23±5.68 whereas rutin used as standard showed 20±1.87µg/ml, respectively.
						Inhibition of Nitric oxide radical	Hexane, chloroform, ethyl acetate and methanol extracts showed an IC50 value of 176.33±15.32, 132.43±13.21,80.75±8.11 and 119.23±10.41whereas rutin used as standard showed20±1.15µg/ml, respectively.
						Inhibition of Superoxide anion radical	Hexane, chloroform, ethyl acetate and methanol extracts showed an IC50 value of 89.91±7.48, 73.23±6.65,68.55±6.62 and 78.21±7.71whereas curcumin used as standard showed5±0.45µg/ml, respectively.
						Hydroxyl radical scavenging activity: Deoxyribose assay	Hexane, chloroform, ethyl acetate and methanol extracts showed an IC50 value of 187.94±17.78,143.24±14.32,92.43± 8.97 and 129.51±11.75 whereas catechin used as standard showed5±0.55µg/ml, respectively.[32]
24	*Solanum Trilobatum*	*Thoothuvalai*	Solanaceae	Leaves	Solanine, Solananine, Sobatum, βSolamarine, Solasodine, Solaine, Diosogenin.	Free Radical Scavenging Activityon Alloxan - Induced Diabetic Rats	There is significant decrease in serum cholesterol levels in Solanum trilobatum extract treated rats, exhibiting a potent hypo cholesterolemic effect and it has free radical scavenging activity and improved antioxidant effect.[33]

25	*Taxus Baccata*	*Thalisa pathri*	Taxaceae	Leaves	Taxol, Taxanins, 10-Deacetyl Baccatin III, Brevifolial, Dihydrotaxol, Taxoids, Taxines I-II, Taxchinin.	DPPH Radical Scavenging assay	Methanol, Acetone, Ethyl acetate and Petroleum ether extracts showed an IC50 value of 105.41±3.12 , 25.24±1.27, 29.84±1.15, and 438.92±4.94, whereas rutin and chlorogenic acid used as standard showed 9.28 and 11.65µg/ml, respectively.[34]
26	*Terminalia Chebula*	*Kadukkai*	Combretaceae	Dry Fruit	Ellagic Acid, Chebulinic Acid, Gallic acid, Ethyl gallate, Punicalegin, Terflavin A, Luteolin, Tannic acid.	DPPH free radical scavenging activity	Methanol extract showed an IC50 value of 4.4197*µg/ml* whereas BHT used as standard showed 29.0297µg/ml, respectively.[35]
27	*Tinospora Cordifolia*	*Seenthil*	Menispermaceae	Bark	Tinosporoside, Tinosporine, Tinosporide, Cordifolide, Cordifol, Heptacosanol, Columbin, Berberine, Palmatine.	DPPH free radical scavenging assay	The ethanolic extract showed the highest scavenging activity (71.49%) at 10 mg/ml and lowest (44.04%) at 1 mg/ml.[36]
28	*Wedelia calendulaceae*	*Manjal karisalai*	Asteraceae	Leaves	Wedelolactones, Phytosterol –A, Luteolin, βAmyrin, Oleonelic Acid, Bisdesmoside, Isoflavonoids, Saponin	In vivo antioxidant mediated defense role against CCl4 induced toxic hepatitis	The marker enzyme levels and the important antioxidant enzymes activity were Protected greatly, besides reducing lipid peroxidation.[37]
29	*Withania Somnifera*	*Amukkura*	Solanaceae	Root	Withaferin A, Withaferin B, Withanine, Withasomnine, Visamine, Somniferine, Phenolics, Flavonoids, Alkaloids, Glycosides, Steroids	DPPH assay	Chloroform, pet-ether and methanol extract showed an IC50 value of 87.414, 144.998 and 267.818 whereas ascorbic acid and BHT used as standard showed5.698and 8.816 µg/ml respectively.
						Reducing Power Capacity Assessment	Chloroform extract exhibited the most reducing power.
						Scavenging of Hydrogen Peroxide	Chloroform, pet-ether and methanol extracts showed 59.45 % ,51.65 % and 54.38 % H_2O_2 scavenging

							activity at 200 µg/ml
						Nitric Oxide Scavenging Assay	Chloroform and Pet-ether extracts showed maximum activity of 53.56% and 42.93% respectively at 100 µg /ml.
						Cupric Reducing Antioxidant Capacity (CUPRAC)	Chloroform extract showed maximum reducing capacity.[38]
30	*Zingiber Officinale*	Inji /chukku	Zingiberaceae	Rhizome	Gingerols or Diarylheptanoids, Shogaol And [6]-Dehydroshogaol, Zingiberine, Zingerone, Galanals A & B	DPPH radical scavenging activity	Ginger extract showed an IC50 value of4.25 ± 0.07 mg/ml.
						ABTS radical cation assay	Ginger extract showed an IC50 value of 0.40 ± 0.014mg/ml.[39]

S.No	Siddha formulations	Ingredients	Assay	Pharmacological View
1.	*Triphala chooranam*	*Emblica officinalis* *Terminalia chebula* *Terminalia bellerica*	DPPH radical scavenging activity	*Triphala* showed an IC50 value of 7 mg/ml
			Superoxide radical scavenging activity	*Triphala* showed an IC50 value of 42 mg/ml.[40]
2.	*Panchadeepakini chooranam*	*Zingiber officinale* *Piper nigrum* *Piper longum* *Elettaria cardamomum* *Cuminum cyminum*	DPPH radical scavenging activity	The water extract of chooranam exhibited radical scavenging power of 81.04%
			Superoxide radical scavenging activity	The water extract exhibited 85%activity at 1000 g/L
			Hydrogen peroxide inhibition	The water extract exhibited 76% inhibition at 1000 g/L
			Hydroxyl radical scavenging activity	The water extract exhibited 81% inhibition at 1000 g/L.[41]
3.	*Muthuchippi parpam*	*Pinctada margaritifera* *Justicia adhatoda* *Vitex negundo* *Curculigo orchioides*	ABTS radical cation decolorisation assay	It showed 69.18% inhibition
			Inhibition of DPPH radical	It showed 63.01% inhibition.[42]
4.	*Poornachandrodaya chendooram*	*Mercurial preparation with gold and sulphur*	DPPH radical Scavenging assay	At 125 µg /ml, the aqueous extract showed highest inhibition
			Hydroxyl Radical Scavenging Activity	At 400µg /ml, the aqueous extract showed highest inhibition.[43]

Pancha Deepakini Chooranam

It is one of the herbal preparations in Siddha, 1-2 grams twice or thrice a day can be administered along with honey or ghee for chronic bronchitis, asthma, viral hepatitis, diarrhea, stomachache, gonorrhea, cough and tumors.[41]

Muthuchippi Parpam

200-400 mg twice a day can be administered along with butter or ghee for Piles, Fistula, Emaciation, Cough and Bronchitis.[42]

Poorna Chandrodaya Chendooram

100-200 mg twice a day can be administered along with honey or beetle leaf juice for tuberculosis, jaundice, fever, rat bite, cancerous ulcer, sprue and male sterility.[43]

Conclusion

This article has been discussed the anti oxidant property of herb and its therapeutic usage. Siddha System of Medicine reveals much more anti oxidant herbs which has to be reviewed further. This is the time to prove scientifically the views of Siddhars who discussed elaborately about the *Kayakarpam* methods. Many life style disorders like diabetes; hypertension can be effectively prevented by the siddhar said *Kayakalpam* herbs and *Kayakalpam* preparations. Further clinical studies are to be carried out for the confirmation of antioxidant effect clinically.

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