Prevention of COVID 19 - Siddha perspective

Review Article

Anand Ganapathy A¹, Alaganandam Kumaran², Lekha G S*³

¹. Chemical Sciences and Technology Division, CSIR-NIIST, Thiruvananthapuram.
². Principal Scientist, Chemical Sciences and Technology Division, CSIR-NIIST, Thiruvananthapuram.
³. Research Officer, Siddha Regional Research Institute, Poojappura, Thiruvananthapuram.

Abstract

Introduction: Siddha is one of the ancient traditional medicine systems originated in South India which incorporates the extensive use of herbs, inorganic substances and animal products for maintaining a healthy life. Siddha system of medicine (SSM) has diverse and extensive use of natural resources for the prevention and management of comorbid conditions, widespread epidemic or pandemic diseases. Methodology: This article summarizes on Siddha methodologies and practices that are obtained from major scientific databases such as SciFinder, Pubmed, Scopus, Science Direct, Google Scholar and Springer using primary search terms as COVID-19, SARS-CoV-2, epidemic, immune-modulatory, antiviral, environmental sanitization and Siddha. The collected data’s are extracted as SARS-COV-2 outline, Basic concepts, communicable diseases and preventive measures revealed in Siddha system of Medicine. Moreover the authors have tabulated the herbs used as health promoters and immune-modulators in Siddha, herbs used for fumigation and sanitization and the herbal ingredients used in important Siddha formulations for the management of infectious diseases. Conclusion: Many of the active principles present in the herbs are studied, proven to be effective immune-modulators, antivirals, anti-asthmatic and anti-inflammatory agents, which may also be effective towards the control of COVID-19. However, further scientific studies and data are required to support the use of Siddha medicines and herbs.

Key Words: COVID-19, SARS-CoV-2, Siddha, Immune-modulatory, Antiviral, Sanitization.

Introduction

The novel coronavirus pneumonia (coronavirus disease 2019, COVID-19) has now infected a total of 21,294,845 people and has claimed 761,779 deaths globally as on August 16, 2020 (1). Despite all the advancements in the 21st century in the field of medical sciences and advanced research, health problems and diseases have again led humankind to great distress. It has witnessed three major viral outbreaks in the current century- SARS-CoV, MERS and SARS-COV-2 (2) whereas the latter SARS-CoV-2, highlights the need for control in this highly pathogenic epidemic.

Due to the high infectivity of COVID-19, than its predecessors, more and more of the population are susceptible to higher respiratory infections and death (3). The high chance of human to human transmission is due to the presence of spike protein, which has a 10-20 times affinity for human angiotensin converting enzyme-2 (ACE2) for viral replication as compared to other SARS-CoVs (4).

Currently, there is no proven drug or vaccine for the treatment of COVID-19. The available methods include the use of supportive measures aimed at managing the symptoms such as fever, dehydration, respiratory disorders and other clinical symptoms. Due to the morbid and fatal nature of COVID-19, and the absence of any treatment measures, many of the clinically available antivirals, ACE2 inhibitors, immune-modulators, non-steroidal anti-inflammatory agents (NSAIDS) and corticosteroids, etc. are being repurposed.

Because of the numerous complications involved in the drug and vaccine development processes, the traditional systems of medicine are explored for their preventive and supportive care to the infected patients. In addition, some of the uncontrolled studies containing herbal products from traditional medicines claim a direct effect on the virus. Siddha system of medicine, practiced in South India has a close affinity towards Ayurveda and yet maintains a distinctive identity of its own by considering humans as a universal entity and implies that any change in the environment will have an influence on human existence and living. This system of medicine emphasizes the usage of botanical drugs for many severe respiratory diseases (5). Several of these drugs and formulations have been scientifically proven to be pharmacologically active against specific viruses such as Dengue and Chikungunya (6–8), and also possessing significant immune-modulatory effects (9). In this review, we present a brief outline on SARS-COV-2, and the Siddha concept of infectious and epidemic diseases along with their preventive measures in Siddha.

* Corresponding Author:
Lekha G S
Research Officer, Siddha Regional Research Institute, Poojappura, Thiruvananthapuram, India.
Email Id: lekha_doctor@yahoo.co.in
Methodology

The authors searched the Siddha medicinal literatures available in Siddha Regional Research Institute and CSIR library for information related to infectious and epidemic diseases and a total of nine important textbooks- Siddha Vайдha Thirattu, Therayar Maha Karisal, Therayar Yamagam, Brahama Muni Karukkadai, Yogi Vatha Kaviyam, Agasthiyar Vallathi, Yugi vaidhya cinthamani, Noi illa neri and Agasthiyar Kannam Soothiram were reviewed: Other research articles, literatures and books were also consulted for more details. The latest information regarding SARS-CoV-2 and COVID-19, were obtained through systematic search from major scientific databases such as SciFinder, Pubmed, Scopus, Science Direct and Springer. The keywords used were SARS-CoV-2, COVID-19, treatment, transmission. In addition to the same search engines, Google Scholar search was also performed to obtain evidence regarding Siddha drugs or formulations prescribed during epidemics. For this search, we used the terms Siddha, environmental sanitization, dengue, influenza, epidemic, antiviral, immunomodulatory and phytochemicals along with the names of drugs, according to their use. Time restriction was not made to extract the most useful information.

Brief outline on SARS-COV-2

Till date, seven human CoVs (hCoV) have been identified, capable of infecting humans: 229E and NL63 (alpha coronaviruses); OC4, HKU1, MERS-CoV and SARS-CoV (beta coronaviruses); and SARS-CoV-2 or COVID-19. Coronavirus are enveloped, single stranded positive RNA viruses belonging to Coronaviridae family, consisting of a large club- or petal-shaped surface projections or spikes which resembles that of the solar corona (10). Member viruses of this family can cause respiratory failure, enteric and hepatic dysfunction as well as neurological disorders in different animal species including cattle, cats, camels and bats.

Preliminary genetic analysis studies of the earlier cases from China designated L and S strains of SARS-CoV-2, where the L-type was found to be more frequent (11). In addition, the virus was first discovered through the use of high-throughput sequencing and broncho-alveolar lavage fluid samples from infected patients (12). In addition, the extensive transmission of the virus over several continents summarize the fact for genetic diversity and the presence of three prominent sites in Orf1ab polyprotein in encoding Nsp6, Nsp11, Nsp13, and one in the Spike protein designate recurrent mutations, thereby suggesting convergent evolution and possible cause for adaptation in the human body (13).

The coronaviruses consist of four structural proteins, namely spike, membrane, envelope and nucleocapsid. Spike protein is composed of two functional subunits: S₁ and S₂ which are responsible for binding and fusion of the viral and cellular membranes (14). In 2003, it was identified that ACE2 was a functional receptor for SARS-CoV (4) and the structural and functional analysis revealed the high affinity of spike for SARS-CoV-2 to ACE2 (15,16). ACE2 expression was also found to be high in lung epithelial tissue as compared to other organs such as heart, ileum, kidney and bladder, indicating SARS-CoV-2 primarily affects the respiratory system, in spite other organs are also involved (17). The other notable feature is the cleavage of polybasic cleavage site (RRAR) at the junction of S₁ and S₂ subunits by furin and other proteases which is effective for the determination of viral infectivity as well as host range (18).

In addition, it is estimated that adults are more prone to COVID-19 than infants or young children (19). Some of the hypotheses include (i) the expression of ACE2 was more abundant in adults as the human lung epithelial cells continue to develop following birth (20) (ii) with ageing, the pro-inflammatory mediators also increase, that govern the neutrophil functions and the low capability of the T-cells at early stages of birth (21) (iii) the concurrent presence of other viruses also in the lung mucosa and airways are frequent in children and can lead to competition with SARS-CoV-2 and thereby limiting its growth (22).

Basic Concepts and infectious diseases in Siddha System

According to Siddha system, all substances in the universe are composed of five basic primal elements; earth, water, fire, air and space (23); where the human body is considered as an assortment of three humors and seven physical components. Any changes in the environmental factors- air, water, habitat and season are considered accountable for disease emergence (24). These environmental, epidemiological, seasonal and water-borne diseases can be compared and treated with the use of Noi Nadal (Siddha Pathology) concepts (23). In Agasthiyar Pallu, 82 Siddha drugs are described which are extensively used to fight infectious and communicable diseases (24).

The Siddha system of medicine involves the concepts and relationships of humors within the body- vali/vata (wind), azhal/pitta (bile), and aiyakapha (phlegm), where the respective pathological condition can be determined by the investigation of nati (pulse) to determine the nature of the humor responsible. According to Siddha concept, pulsation and its movement is exhibited as different types such as movement similar to that of a swan or peacock for cases of deranged vata humor and that of a hen or ant, if there is pitta imbalance; that of a fly or vulture in cases of vitiated kaptha (24). An experienced Siddha physician is able to differentiate and identify status of humors through the pulse movements whether in right- or left-side body parts (25), thereby identifying the nature and cause of disease.

Epidemics/pandemics are mentioned as ‘Uzhi Noi’ or ‘Kothari Noi’ in Siddha system. In general, they are classified under “Kollai Noikal” which most commonly occur at the time of “Ayana Santhi” months (end a month of Uthara Ayanam & Thatchana Ayanam) fall on Aadi (mid of July to August) and Margazhi (mid of December to January) month in Tamil Calendar. It is believed that in those days, the immunity of human beings will be low; based on Trithodam or Mukkutram
theory (depended on three humors vata, pitta and kapha) the occurrence of diseases are raised based on the derangement of Mukkutram. Usually, Thottru Noigal (communicable diseases), associated with Aiya kutram (Respiratory-related illness), gets affected due to its Sthiram gunam (stability factor). Guru Naadi quoted that, Thottru Noigal is generally caused by Kirumi (Pathogens or Microbes). The symptoms are due to Noiyinan vannai (immunity of an individual); if it is good, the individual will not be affected. Hence the Siddha formulations or habits are designed to neutralize the Aiya kutram (24,26) and to maintain the immunomodulatory mechanism during this period.

In accordance to the Siddha system of medicine, COVID-19 can be effectively described as a Thotru Noi (communicable disease) which is caused due to the derangement of immune system of the body to fight the invading Kirumi (virus or pathogen) which directly causes Aiya noigal (respiratory related illness) due to changes in food, behaviour and surroundings. In addition, the symptoms of COVID-19 such as mild fever, sore throat, malaise, headache, shortness of breath, pneumonia and respiratory distress can be compared to that of Kapha suram. Also, people with low immune power or immunity are also susceptible to epidemics as described by Tirumanitiram by Saint Tirumular (24).

In Siddha, all types of pyrexia including vector-borne diseases such as malaria, dengue etc. are classified as a total of 64 types and collectively called as Suram. Among them, Siddha equates dengue to Pitta Suram, because the symptoms such as haematuria, anorexia, vomiting, nausea, myalgia, dysentery, fever followed by chills are similar to those described in Sura Vadagam, which explains the treatment as well. Literatures such as Siddha maruthuvam also describe similar symptoms for dengue fever. Whereas Agastiyar sura nool 300 describes that the ‘Pitta suram’ can cause bleeding correlating to haemorrhages (kuruthi azhal) in dengue fever and the symptoms described above corresponds with the definition of dengue fever by WHO (8,27).

In the same way Siddha equates COVID-19 to Kapha suram, because the symptoms of Kapha suram/ S lethma suram are fever, cough, throat pain, anosmia, dysgeusia, shortness of breath and fatigue which can be correlated with mild stage SARS-CoV-2. In severe stage, the symptoms are related with Sanni staging of Kapha suram or Kabavatha suram (28). The literatures in Siddha system explores various formulations for the treatment of Kapha suram or Kabavatha suram and Sanni noi.

Therefore, it is evident that without identifying the microbes and other detrimental substances, Siddha healers or scholars could recognize and apprehend the reason, source and mode of transmission of contamination, thereby managing infectious epidemics. Thus the theories and observations made above supports the effective use of Siddha medicine as a significant therapy against current health problems.

Prevention of epidemics as per SSM

From Siddha literatures, it is found apparent that the “Pini anugaa vidhi” (keeping diseases afar) are more important than the cure for the particular disorder. Therefore, the Siddhars have recommended some basic life guidelines that are to be followed for a healthy life and wellbeing. Some of the concepts such as Thinai/ Nilam ozhukkam (habitant disciplines), Kaala ozhukkam (seasonal discipline), Naal ozhukkam (daily regimen) and Unavu (diet) are still being followed along with Kayakalpam as a preventive measure against diseases.

Thinai ozhukkam stresses the importance of habitat in ancient Tamil literature depending on landscape and landforms- Kurinchi (mountains and surroundings), prone to fevers affecting hematopoietic systems; mullai (forest), prone to diseases affecting joints and nerves; neithal (sea shores and beaches), prone to liver and intestinal diseases, palai (dry and desert lands) are considered prone to all kinds of diseases; and marutham (agricultural land) is said to have all the humors in equilibrium and hence considered the best for living (23).

Kaala ozhukkam is based on the seasonal changes that affect the humors. The diet and drugs that help in normalizing these humors are also recommended by the Siddhars. During monsoon season, buttermilk mixed with dried ginger, root of Piper longum L. and Plumbago zeylanica L. are considered suitable along with food rich in fiber content; walking on wet surfaces with bare foot are to be strictly avoided. In the autumn season, diet containing pulses, rice, goat milk, amla, green and leafy vegetables are deemed essential and day time sleeping is to be avoided. In the winter season, urududal (split black gram) and a diet consisting of wheat should be included with breakfast regimens. The medicated oils that minimize vata should be applied on the head and body as recommended. In case of spring season, rice, ghee, kezhvaragu (ragi), fruits like drupe, plantains along with honey are to be included in the diet. Dried roots of Vetiveria zizanioides (L.) are highly recommended to be included while boiling water for drinking. During this season, sleeping at daytime are restricted and wakefulness at night are to be avoided. In case of summer season, easily digestible foods rich in high water and fiber content such as grapes, pomegranate, cardamom, iluapipo (flower of Madhuca longifolia (J. Konig) J.F. Macbr.), and palm jaggery are recommended. Moreover, alcohol consumption is to be strictly avoided during this season (24,26). The diet regimens and sleep patterns are to be strictly maintained in order for healthy wellbeing, according to Siddha concept.

Naal ozhukkam involves the daily discipline that has to be followed on a day; where an entire day is divided into six minor individual parts based on time, called sirupozhuthu (small periods) as each part is dominated by a particular humor. Daily lifestyle regimens such as waking up between 4 to 6 am, drinking pure water immediately after waking and use of twigs from Asoku (Saraca asoca (Roxb.) Willd), Vembu (Azadirachta indica A. Juss.), Aathi (beedi leaf
tree), Aal (Indian banyan), Vael (Gum Arabic tree) for brushing are considered to be very healthy and hygienic. Application of Pancha karpam which is a mixture of five herbal ingredients such as Kasthuri manjal (aromatic turmeric), Milagu (pepper), Vembin vithu (seed of neem), Kadukkai thol (Terminalia chebula Retz. fruit) and Nelli paruppu (gooseberry seed) mixed with boiled milk, on head before bathing helps for keeping the body cool and balance the humors. Eating only when required and on a right quantity is essential to maintain the humor. The sleeping beds should be used according to the season and pathological conditions. For example, in cases of giddiness, vomiting and aggravated pitta, sleeping on Thazhampai (screw pine leaves) padukkai (mat) is advised (24).

Unavu involves the dietary regimens for a safe and healthy life. According to Siddha, Unavae marunthu (Food is Medicine) as proclaimed by the great Siddhar Thiruvalluvar in his famous work Thirukkural. The dietary regimen during the intake of Siddha medicine is termed as pathyam and apathyam (23,29,30).

Medicinal ingredients such as Velavarai (Dolichos lablab L.), Manathakkali (Solanum nigrum L.), Nerunchil (Tribulus terrestris L.), Mookiraitai (Boerhavia diffusa L. nom. cons.), Musumusukai (Mukia maderaspatana (L.) M. Roem.) etc. are recommended for the balancing of Vata humor. Whereas, Cucumber (Cucumis sativus), Vallarai (Centella asiatica (L.) Urban), Puliirai (Oxalis corniculata L.), Kovai (Coccinia grandis (L.) Voigt), Ponnusuttai (Sida acuta Burm.F.), Oritazhttaramarai (Ionidium suffruticosum Ging.), Sundai (Solanum torvum Sw.) etc. are useful in the maintenance of pitta and; Brinjal, Peipudal (Trichosanthes cucumerina L.), Bittergourd, Pepper, Turmeric, Mustard, Sundai (Solanum torvum Sw.), Gooseberry etc. are essential for the control of kapha as per Siddha literature. Also, Kayakalpa drugs such as Citrus limon (L.) Burm. (elumicchai), Terminalia chebula Retz. (kadukkai), Strychnos potatorum Linn. (theethran), Phyllanthus emblica L. (nelli), Aegle marmelos (L.) Correa (vilvam) help in providing essential nutrients to the body and act as a preventive against most of the diseases (23). Meat and fish are strictly restricted in certain type of diseases and during Siddha treatment period. A number of immunomodulatory drugs that are encouraged during epidemics are given in Table 1.

Role of SSM in environmental sanitization

Fumigation, called “Pugai” in Siddha represents the artificial saturation of surroundings with fumes or smoke of any herb or aromatic substance. The purpose of this procedure is to control the microbial infections. Pugai is one among the 32 types of external therapies explained in Siddha literature Theriyar Tharu and was used as a preventive measure to protect themselves from communicable diseases (24). It is considered as one of the best methods employed for disinfection and sterilization of the environment instead of chemical fumigants. During fumigation, the surroundings as well as the persons involved in the process are benefited by the usage of medicinal herbs (31).

Pugai involves fumigating the surroundings by burning dried medicated herbal juices or extracts over a cloth, where the cloth acts as Thiri (wick). Similarly, Thippili (Piper longum L.), Manjal (Curcuma longa L.), Omam (Trachyspermum ammi (L.) Sprague), and Milagu (Piper nigrum L.) are ground, then applied on a cloth and soaked with Neem oil. This mixture was allowed to smolder and the smoke was allowed to be inhaled by the patient and/or used as an environment sanitizer (31). Ellu (Sesame indicum L.), Payaru (Vigna radiate (L.) R. Wilczek), Kadugu (Brassica juncea (L.) Czern.), egg shell, fecal matter of dog, outer skin of the Poondu (Allium sativum L.), Kattamanaku (Jatropha curcas L.), Thulasai (Ocimum sanctum L.), Devadaru (Cedrus deodara (Roxb.) G.Don) are also used for the same purpose. Karuvelam pisin (Gum of Acacia Arabica), roots of Murungai (Moringa oleifera Lam.), Erukku (Calotropis gigantea (L.) Dryand.), azhinjil (Alangium salvifolium (L.f.) Wangerin) and Sivanan vembu (Indigofera aspalathoides Vahl. ex. DC.) are made into a fine powder, and a pinch is added to burning charcoal and was used to fumigate the surroundings as well as the patient (24).

Surutti (medicated cigar) is made by rolling dry medicated leaves, for eg., Adathodai surutti. The fumes of Sathakuppai (Anethum graveolens L.) dry leaves are extensively used around the patient’s surroundings as a disinfectant. These fumes not only cleanse the affected areas but also relieves the mental stress of the subjects (31). In Siddha literature, Sage Agasthiyar’s Maanidakkirigai-64 explains the use of various drugs for Pugai in the treatment of Psychiatric ailments (24).

Nowadays, Padigara neer (alum) and turmeric water (Curcuma longa L.) are also used as an effective hand sanitizer. Agasthiyar kuzhambu was extensively used in the dose of 3 to 5 paddy weight to fumigate before the origination of chemical sprays or fumigants (31). Some of the other common herbs that are used for fumigation as well as sanitization in Siddha are: Shorea robusta Roth., Argemone mexicana L., Costus speciosus (J. Konig) C. Specht, Anethum graveolens L., Boswellia serrata Triana & Planch., Santalum album L., Abutilon indicum (Link) Sweet, Cedrus deodara (Roxb.) G. Don, Nicotiana tabacum L., Mangifera indica L., Crinum asiaticum L., Aguilaria agallocha Roxb., Lawsonia inermis L., Ruta chalepensis L., Justicia beddomei (C.B. Cl) S.S.R. Bennet, Madhuca longifolia (J. Konig) J. F. Macbr., Datura metel L., Solanum surattense Burm. f., Saccharum officinarum L., Rhus succedanea L. (31). The information regarding these medicinal drugs along with other natural fumigants are available in Table 2.

Many of the medicinal herbs contain volatile and essential oils which can act as excellent antimicrobial, for example Manjal (Curcuma longa L.), Vembu (Azadirachta indica A. Juss.), Sadakuppi (Anethum graveolens L.), Milakukkirai (Mentha piperita L.), Karupuramam (Eucalyptus globulus
Prevention of COVID-19: Siddha perspective

The data collected from the literatures and Manuscripts reveal the following preventive measures of COVID-19 in Siddha system of medicine.

According to the Siddha system of medicine, food is considered as medicine and proper intake of food can provide immunity to the body. A number of immunomodulatory herbs are reported in Siddha as a preventative during epidemics are given in Table 1. Immunomodulation is the ability to alter the immune response in humans and animals against infectious agents, stimulation of immune system is preferred for patients those who have compromised immunity and immune-suppressants are required for patients having inflammatory diseases.

In general, an infusion made up of half teaspoon of chukku (dried ginger) in two litres of water can be used for drinking; the use of inji (ginger) thenooral / inji tea / adhimaduram (liqueoric) tea is recommended for immunomodulation. It is highly advised to avoid drinking milk before bedtime and if needed for children, adding a quarter teaspoon of manjal (turmeric) with milagu (pepper) is advised. Steam inhalation therapy by using Tulasi / Nuchi / Manjal and gargling with a pinch of salt and turmeric is also highly recommended. The use of karappan pandam (allergic food) should be devoid from the daily diet. Also, the diet may include Nandu kanji (Crab soup), Pancha mutti kanji (5-grain gruel) and Irumurai vaditha kanji (double-cooked gruel) are highly recommended to include in the daily regimen as per the Siddha literatures (36,37) and the Ministry of AYUSH, Govt. of India (38).

In spite of the other resources, 108 medicinal herbs called as karpa mooligaikal are predominantly used in Siddha system for treating certain diseases and as an antioxidant & immunomodulator which were used extensively in case of dengue and HIV epidemics (8.39). These plants are also rejuvenators to boost health and thereby prevent chronic diseases and reduce ageing (40).

Kayakalpa (Kaya- Body, mind and psyche and Kalpa- Transmutation) is one of the significant and exclusive methods of Siddha system which combines both human and natural sources (herbs) for rejuvenation and transformation as prevention from diseases (23,24).

The treatment regimen involves lifestyle measures and routines involving breathing regulation, sperm conservation, administration of carefully processed mineral drugs or potent herbs such as Katrazhai (Aloe indica Royle), Bhringaraja (Eclipta alba L. Hassk) and Neem (Azadirachta indica A. Juss.) etc. which are beneficial to the human internal system as a whole (41). Also, the intake of Mappu, which is a meticulously prepared mixture of three salts are considered to have prophylactic action besides the rejuvenation of body (13).

In addition, the effectiveness of a number of Siddha medicinal formulations or drugs are being scientifically validated and proven, thereby supporting and promoting the value of Siddha system of medicine. For example, Brahmananda bairavam mathirai, Nilavembu kudineer, Vishnu chakram are effective against chikungunya infections (7,8,42). Evidence based Siddha medications such as Nivalembu kudineer, Adathodai kudineer, Veppilai chooranam, Ammukkara chooranam, Amman Pachiris karkam for dengue infections (8,39);

Urai mathirai for its immunomodulatory effect (9); Kapa Sura, Sarva Sura and Visha Sura Kudineers (decoctions) from the Siddha literature Kaaviya Sura Nool are also useful against Swine flu fever, as these formulations are found to contain major medicinal herbs and phyto-constituents that are proven to be antiviral and antipyretic agents (28,39,43,44). Other polyherbal Siddha preparations such as Chitramuttu Kudineer, Chukku kudineer, Adathodai manapagu are some of the classical medications used by Government of Tamil Nadu, India, in the year 2012 when the state was plagued by dengue fever (45).

Urai mathirai is a Siddha formulation made up of 10 herbal ingredients of hot-potency and pungent taste, extensively used for the prevention of recurrent respiratory infections. The medication as a whole after the digestion in stomach gets transformed into a fire moiety which increases the Azhal (immunity) of the body. As according to Siddha system “Vatamaai Padaiithu, Pitta Vanniyai Kathu, Sethuma Seethamai Thudaithu” meaning Vata is responsible for creation, Pitta for prevention and Kapha for destruction. Infection occurs if the immunity is challenged and it can be rectified with the increase of Azhal. The ingredients of Siddha polyherbal formulation Urai mathirai are chukku (Zingiber officinale Roscoe), adimathuram (Glycyrrhiza glabra L.), akkirakaram (Anacyclus pyrethrum (L.) Lag.), vashambu (Acorus calamus L.), catikkai (Myristica fragrans Houtt.), kattukka (Terminalia chebula Retz..Retz.), masikkai (Quercus insectoria G.Olivier), acanam (Allium sativum L.), tippili (Piper longum L.) and perunkayam (Ferula asafoetida L.) which are having immunomodulatory activity (7,8).

As COVID-19, is considered as a Thotru noi having similar symptoms as that of Kabasuram and Sanni noigal in Siddha literature, the effective management may be acquired by the use of anti-inflammatory, antiviral, antipyretic, immunomodulators in order to reduce or control the symptoms (24). Some
of the most extensively used Siddha formulations which are said to contain the above said pharmacological activities are (i) Kaba Sura Kudineer (ii) Nila Vembu Kudineer (iii) Visha Sura Kudineer (iv) Sarva Sura Kudineer (28,38,39,42,44). The contents of the said Siddha preparations are given in Table 3.

The four Siddha formulations contain a blend of medicinal herbs which are to be administered as a liquid at a dose of 60 ml twice a day before food. These formulations contain specific immunomodulators for respiratory care, antivirals, antipyretic and anti-inflammatory agents such as Sitrarathai (Alpinia galanga (L.) Willd.), Amukkara (Withania somnifera (L.) Dunal), Kodiveli (Plumbago zeylanica L.), Charanai ver (Triantha decandra L.), Peyputtal (Trichosanthes cucumerina L.), Koraik kilanku (Cyperus rotundus L.), Parpatakam (Mollugo cerviana (L.) Ser.), Nilavembu (Andrographis paniculata (Burm.f.) Nees), Keezhanelli (Phyllanthus niruri L.), Seenthil (Tinospora cordifolia (Thunb.) Miers) which are individually proven for their respective pharmacological actions (8,28,39,43,44).

Siddha system of medicine also contains different formulations such as Adathodai Managapu, Nellikkaillagam, Vasantha Kusumakaram, Thalisathi Vadagam, Bramananda Bairavam, Thirthoda Mathirai, Seenthil Chooranam, Pachatkarpooora Mathirai, Swasakudori Mathirai, Thippili Rasayanam, etc which are the effective herbal formulations in Siddha which can be employed for the control of Kabasuram – fever with Respiratory illness (38,46,47).

Conclusion

It can be summarized that prevention of epidemics are possible through the methods of Siddha system of medicine by maintaining a stable and healthy relationship with the human body and the environment. This review is aimed to update the readers about the classical Indian system of medicine, which is built on the vast experiences on observation and treatment regimens of the ancient saints of India. The Siddha concepts of sanitation, diet and immunomodulation are completely dependent on the mind and natural surroundings of human population. Therefore, Siddha system of medicine is a bundle of desireous information that has to be explored, explained and implemented to understand the ancient knowledge of maintaining a relationship with the environment for better wellbeing.

The medicinal herbs which are being long used in ancient cultures are now being proven to be effective through scientific studies although more controlled clinical data are of utmost importance. The concept of pugai as a mode of fumigation and sanitization of surroundings and environment, the use of herbal hand washes such as turmeric and the use of kayakalpa technique and various other polyherbal decoctions with respect to the daily and seasonal variations with a strict and proper diet lead to a long and healthy life to our ancestors.

Therefore, it can be concluded that the increase in infectious diseases or pandemics will continue to transpire with the emergence of severe organisms or microbes; and an effective method of control and prevention will be of importance. Hence, the herbal drugs and concept of Siddha medicine and lifestyle may prove effective and cheap products in the development of medications. This review suggests the use of traditional system of Indian medicine such as Siddha to shed light along with the modern system of medicine to maintain and stable and healthy lifestyle remarkably during pandemics.

Table 1: Herbs used as health promoters and Immunomodulators according to Siddha.

<table>
<thead>
<tr>
<th>Botanical name and family</th>
<th>Siddha name</th>
<th>Part used</th>
<th>Location</th>
<th>Traditional uses</th>
<th>Constituent responsible</th>
<th>Mode of action or rationale</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cedrus deodara (Roxb.) G. Don, Pinaceae</td>
<td>Devadaru</td>
<td>Wood</td>
<td>Jammu and Kashmir, Himachal Pradesh, Nepal, China</td>
<td>Essential oil as insect repellent, aromatherapy, astringent, antifungal</td>
<td>Volatile oil constituents</td>
<td>Immunostimulant, anti-inflammatory, antioxidant</td>
<td>(48–50)</td>
</tr>
<tr>
<td>Cinnamomum tamala (Buch. Ham.) T. Nees &amp; C.H. Eberm., Lauraceae</td>
<td>Lavanga pathiri</td>
<td>leaves</td>
<td>Bangladesh, Nepal, China, India</td>
<td>Antidiabetic, carminative, sedative, antidepressant, antidiarrhoeal, astringent, stimulant</td>
<td>A-type procyanidin oligomers</td>
<td>Immunomodulatory, antimicrobial</td>
<td>(37,51)</td>
</tr>
<tr>
<td>Alpinia galanga (L.) Willd., Zingiberaceae</td>
<td>Arathai</td>
<td>Rhizome</td>
<td>West Bengal, Assam, Cambodia, Thailand, Japan</td>
<td>Cold, sore throat, antimetic, analgesic</td>
<td>Neolignans and sesquineolignans</td>
<td>Immunomodulatory, antioxidant</td>
<td>(52–54)</td>
</tr>
<tr>
<td>Plant Name</td>
<td>Part</td>
<td>Place of Origin</td>
<td>Uses</td>
<td>Active Principles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Withania somnifera (L.) Dunal., Solanacea</td>
<td>Root</td>
<td>Tamil Nadu, Rajasthan, Andhra Pradesh, China, Yemen</td>
<td>Blood tonic, treat irregular menstruation, anaemia, erectile dysfunction</td>
<td>Withaferin A, Immunostimulant, anti-inflammatory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tinospora cordifolia (Thunb.) Miers, Papilionaceae</td>
<td>Leaves</td>
<td>Haryana, Madhya Pradesh, Assam, China, Bangladesh, Vietnam, Malaysia, Sri Lanka</td>
<td>Memory booster, antispasmodic, anti diarrhoeal, stomachic, tonic, bronchitis, promotes longevity, anti-allergic</td>
<td>Alkaloids, flavonoids, saponins, Immunomodulatory, antiviral</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cynodon dactylon (L.) Pers., Poaceae</td>
<td>Juice</td>
<td>Madhya Pradesh, Himalayas, Pakistan, Indonesia, United States</td>
<td>Haemostatic, diuretic, antipyretic, treatment of bronchitis, leucoderma, diarrhoea, hypertension</td>
<td>Protein fraction, Immunomodulatory, antioxidant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curcuma longa L., Zingeberaceae</td>
<td>Rhizome</td>
<td>Most states in India, Pakistan, Malaysia, Indonesia, Ethiopia, Japan, China</td>
<td>Natural antiseptic, disinfectant, analgesic, remedy for skin diseases, indigestion, arthritis</td>
<td>Aqueous rhizome powder, Immunostimulant, anti-inflammatory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plumbago zeylanica L., Plumbaginaceae</td>
<td>Root</td>
<td>Assam, Australia, Oman</td>
<td>Expectorant, astringent, laxative, abortifacient, memory booster,</td>
<td>Seselin, Immunomodulator, anti-inflammatory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Justicia adhatoda L., Acanthaceae</td>
<td>Leaves</td>
<td>Eastern Ghats, Assam, Himalayas, China, Nepal</td>
<td>Cough, fever, asthma, dysentery</td>
<td>Vasicine, Immunostimulant, antioxidant, antimicrobial</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enicostemma axillare Lam., Gentianaceae</td>
<td>Whole</td>
<td>Tamil Nadu, West Bengal, Kerala</td>
<td>Stomachic, tonic, antipyretic, remedy for dyspepsia, malaria, leprosy</td>
<td>Swertiaumarin, Immunomodulatory, antioxidant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indigofera aspalathoides Vahl. ex. DC., Fabaceae</td>
<td>Aerial part</td>
<td>Pakistan, Indonesia, Malaysia, Sri Lanka</td>
<td>Demulcent, sedative, analgesic, antispasmodic, remedy for leprosy, malaria, kidney stones</td>
<td>Kaempferol 5-O-β-D-glucopyranoside, Immunostimulant, anti-inflammatory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senna alexandrina Mill., Fabaceae</td>
<td>Seeds</td>
<td>Tamil Nadu, Egypt, South Africa, China</td>
<td>Remedy for dysuria, diabetes, night blindness, epilepsy</td>
<td>Rhein, Immunostimulant, antimicrobial</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 2: Herbs used for fumigation and environmental sanitization as per Siddha system.

<table>
<thead>
<tr>
<th>Botanical name and family</th>
<th>Siddha name</th>
<th>Part used</th>
<th>Location</th>
<th>Traditional use</th>
<th>Phytochemistry</th>
<th>Mode of action or rationale</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Curcuma longa</em> L., Zingiberaceae</td>
<td>Manjal</td>
<td>Rhizome</td>
<td>Most states in India, Pakistan, Malaysia, Indonesia, China, Japan, Ethiopia</td>
<td>Natural antiseptic, disinfectant, analgesic, remedy for skin diseases, indigestion, arthritis</td>
<td>Turmerone, zingiberene</td>
<td>Fumigation, antimicrobial, sanitizer</td>
<td>(51,79,80)</td>
</tr>
<tr>
<td><em>Azadirachta indica</em> A. Juss., Meliaceae</td>
<td>Vembu</td>
<td>Leaves</td>
<td>India, China, Malaysia, Caribbean, South East Asia</td>
<td>Antibacterial, anti-inflammatory, natural antiseptic, antipyretic</td>
<td>Azadirachtin, Nimbin</td>
<td>Fumigation, insecticidal, antimicrobial</td>
<td>(51,61,81)</td>
</tr>
<tr>
<td><em>Anethum graveolens</em> L., Apiaceae</td>
<td>Sadakupai</td>
<td>Leaves</td>
<td>Central Asia, Mediterranean, USSR</td>
<td>Abdominal pain, eye diseases, uterine pains</td>
<td>Scopoletin, umbelliferone</td>
<td>Insecticidal, antibacterial</td>
<td>(66,82,83)</td>
</tr>
<tr>
<td>Plant Name</td>
<td>Region/Origin</td>
<td>Parts Used</td>
<td>Medical Uses</td>
<td>Active Constituents</td>
<td>Pharmacological Activities</td>
<td>Reference Numbers</td>
<td></td>
</tr>
<tr>
<td>------------------------------------</td>
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<td>------------</td>
<td>--------------------------------------------------</td>
<td>----------------------------------------------------------</td>
<td>---------------------------------------------------------------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td><em>Piper longum</em> L., <em>Piperaceae</em></td>
<td>Thippili Seeds</td>
<td>India, Pakistan, China, Europe</td>
<td>Relieve muscular pains, anti-inflammatory, stimulant, stomachic, antidiabetic</td>
<td>Piperine, piperlongumini ne</td>
<td>Antiparasitic, antimicrobial, antibacterial</td>
<td>(9,59,84)</td>
<td></td>
</tr>
<tr>
<td><em>Carum copticum</em> (L.) Sprague ex Turrill., <em>Apiaceae</em></td>
<td>Omam Leaves, seeds</td>
<td>Kerala, West Bengal, Gujarat, Iran, Afghanistan, Pakistan</td>
<td>Carminative, antiseptic, expectorant, antimicrobial bronchodilatory, antitussive</td>
<td>Carvacrol, €-terpinene</td>
<td>Insecticidal, antimicrobial</td>
<td>(66,85)</td>
<td></td>
</tr>
<tr>
<td><em>Piper nigrum</em> L., <em>Piperaceae</em></td>
<td>Milagu Seeds</td>
<td>South India, Vietnam, Brazil</td>
<td>Cough, sinusitis, throat pain, infections, ear ache, gastrointestinal disorders</td>
<td>β-pinene, p-cymene</td>
<td>Antimicrobial, antibacterial</td>
<td>(86-88)</td>
<td></td>
</tr>
<tr>
<td><em>Sesamum indicum</em> L., <em>Pedaliaceae</em></td>
<td>Ellu Seeds</td>
<td>Asia, Africa, Japan</td>
<td>Wound healing, antiviral, analgesic, hypolipidaemic</td>
<td>Sesamin, sesamol, sesaminol</td>
<td>Fungicide, antimicrobial</td>
<td>(36,66,89, 90)</td>
<td></td>
</tr>
<tr>
<td><em>Vigna radiata</em> (L.) R. Wilczek, <em>Fabaceae</em></td>
<td>Cherupayar Seeds</td>
<td>India, China, Bangladesh</td>
<td>Antipyretic, anti-inflammatory</td>
<td>Catechin, gallic acid</td>
<td>Antimicrobial, antibacterial</td>
<td>(55,91,92)</td>
<td></td>
</tr>
<tr>
<td><em>Brassica juncea</em> (L.) Czern., <em>Brassicaceae</em></td>
<td>Kadugu Seeds</td>
<td>Pakistan, India, Bangladesh, Japan, China, America</td>
<td>Stimulant, expectorant, diuretic, used as spice</td>
<td>Zeaxanthin, lutein</td>
<td>Fumigation</td>
<td>(61,93-95)</td>
<td></td>
</tr>
<tr>
<td><em>Allium sativum</em> L., <em>Amaryllidaceae</em></td>
<td>Poondu Outer skin</td>
<td>Asia, Iran, Egypt, Mexico</td>
<td>Stomachic, fever, cough, antibacterial, anti-inflammatory</td>
<td>Allicin, alliin, diallyl sulfide</td>
<td>Fumigation</td>
<td>(32,96,97)</td>
<td></td>
</tr>
<tr>
<td><em>Jatropha curcas</em> L./<em>Euphorbiaceae</em></td>
<td>Kattamanku Leaves</td>
<td>Pakistan, India, South America, China</td>
<td>Lactogogue, stomachic, rubefacient, remedy for diabetes, arthritis, jaundice, malaria</td>
<td>Vitexin, isovitexin, gallic acid</td>
<td>Insecticidal</td>
<td>(51,61,98)</td>
<td></td>
</tr>
<tr>
<td><em>Ocimum sanctum</em> L., <em>Lamiaceae</em></td>
<td>Thulasi Leaves</td>
<td>India and Southeast Asia</td>
<td>Bronchitis, malaria, diarrhea, dysentery, skin diseases, arthritis, eye diseases, insect bites, antibacterial, common cold</td>
<td>Methyl eugenol, carvacrol</td>
<td>Insecticidal</td>
<td>(70,97,99)</td>
<td></td>
</tr>
<tr>
<td><em>Cedrus deodara</em> (Roxb.) G. Don, <em>Pinaceae</em></td>
<td>Devadaru Wood</td>
<td>Jammu and Kashmir, Himachal Pradesh, Nepal</td>
<td>Essential oil as insect repellant, aromatherapy, astrigent, antifungal</td>
<td>Deodarin, cedeodarin, cedrusin</td>
<td>Antiparasitic, antimicrobial</td>
<td>(48,49,55, 64)</td>
<td></td>
</tr>
</tbody>
</table>
### Moringa oleifera Lam., Moringaceae
- **Murungai Roots**
  - **Asia and Africa**
  - Immune booster, anti-inflammatory, abortifacient, cough, common cold
  - Isotrifolin, quercetin
  - Fumigation, antimicrobial (66,86,100)

### Calotropis gigantea (L.) Dryand., Apocynaceae
- **Erukku Root**
  - **Haryana, China, Thailand, Sri Lanka**
  - Antipyretic, purgative, antimicrobial, wound healing activity
  - Calotropagenin, calotoxin
  - Fumigation, insecticidal (51,101,102)

### Alangium salviifolium (L.f.) Wangerin,* Cornaceae
- **Azhinjil Root**
  - **India, China, Phillipines**
  - Emollient, anthelmintic, laxative, diuretic, antidote, purgative
  - Alangidiol, alangicine
  - Antifungal (55,57,103)

### Indigofera aspalathoides Vahl. ex. DC.,* Fabaceae
- **Sivanar vembu Root**
  - **India, Pakistan, Indonesia, Malaysia, Sri Lanka**
  - Demulcent, sedative, analgesic, antispasmodic, remedy for leprosy, malaria, kidney stones
  - Afromosin, genistein
  - Insecticidal, antibacterial (61,69,79,104)

### Shorea robusta Roth. *, Dipterocarpaceae
- **Kungiliya Resin**
  - **India, China, Russia**
  - Astringent, detergent, wound healing effect, remedy for cold, piles, bronchitis and leucorrhoea
  - Fischinidol, Afzetechin tannins
  - Insecticidal (51,105)

### Argemone mexicana L. *, Papaveraceae
- **Kudiyotti poondu Seeds**
  - **Madhya Pradesh, Eastern Ghats, Himalayas, South America, West Africa**
  - Treatment of tumors, warts, skin diseases, inflammation, rheumatism, jaundice, leprosy, microbial infections, malaria
  - Oxyhydrastinin e, Mexicanol, Mexicanic acid
  - Insecticidal, antibacterial (55,57,106,107)

### Costus speciosus (J. Konig) C. Specht., Costaceae
- **Kottam Roots and rhizomes**
  - **Nagaland, Assam, Sri Lanka, Malaysia**
  - Astringent, aphrodisiac, purgative, anthelmintic, depurative, febrifuge, expectorant, tonic, stimulant
  - Cycloartenol, diosgenin, lupeol
  - Fumigation (108,109)

### Boswellia serrata Triana & Planch., Burseraceae
- **Kuntharikk am Resin**
  - **Assam, Bihar, China**
  - Remedy for bronchitis, asthma, cough, diarrhea, dysentery, fever
  - β-Sitosterol, α-Thujene
  - Antifungal, fumigant (32,57,110)
<table>
<thead>
<tr>
<th>Species</th>
<th>Part</th>
<th>Location</th>
<th>Uses</th>
<th>Phytochemicals</th>
<th>Method</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Santalum album</em> L., Santalaceae</td>
<td>Santhanum Wood</td>
<td>Eastern Ghats, China</td>
<td>Tonic for heart, stomach, liver, fever; treatment of diarrhea, piles, vomiting, eye infections and inflammation</td>
<td>Nuciferol, α-Curcumone</td>
<td>Fumigation</td>
<td>(35,55,57, 111)</td>
</tr>
<tr>
<td><em>Abutilon indicum</em> (Link) Sweet,* Malvaceae</td>
<td>Thuthi Seed</td>
<td>Tamil Nadu, Africa, Australia</td>
<td>Diuretic, laxative, demulcent, analgesic, antiulcer</td>
<td>Gossypetin, Vanillic acid, β-Sitosterol</td>
<td>Insecticidal</td>
<td>(70,75, 112)</td>
</tr>
<tr>
<td><em>Tinospora cordifolia</em> (Thunb.) Miers., *Papilionaceae</td>
<td>Seenthal Leaves</td>
<td>Haryana, Madhya Pradesh, Assam, China, Bangladesh, Vietnam, Malaysia, Sri Lanka</td>
<td>Memory booster, antispasmodic, antidiarrheal, stomachic, tonic, bronchitis, promotes longevity, anti-allergic</td>
<td>Quercetin, monocrotaline</td>
<td>Insecticidal</td>
<td>(57,58,68)</td>
</tr>
<tr>
<td><em>Nicotiana tabacum</em> L.,* Solanaceae</td>
<td>Pugayilai Leaves</td>
<td>India, China, North America, Europe, Africa</td>
<td>Treatment of rheumatism, pulmonary ailments, conjunctivitis, bronchitis and pneumonia</td>
<td>Solavetivone, Nor-nicotine</td>
<td>Antibacterial</td>
<td>(55,113,114)</td>
</tr>
<tr>
<td><em>Mangifera indica</em> L.,* Anacardiaceae</td>
<td>Maa Leaves, flower</td>
<td>India, Africa, Middle East</td>
<td>Dentifrice, antiseptic, astringent, diaphoretic, stomachic, laxative, vermifuge</td>
<td>Mangiferin, fisetin</td>
<td>Insecticidal</td>
<td>(59,68, 115)</td>
</tr>
<tr>
<td><em>Crinum asiaticum</em> L.,* Amaryllidaceae</td>
<td>Vidamoongil Leaves</td>
<td>Tropical Asia</td>
<td>Analgesic, antimicrobial, antiemetic, antihelmintic, laxative, skin infections, expectorant, wound healing property</td>
<td>Lycorine, isocraugsodine, criasbetaine</td>
<td>Insecticidal</td>
<td>(31,116, 117)</td>
</tr>
<tr>
<td><em>Aquilaria agallocha</em> Roxb.,* Thymeleaceae</td>
<td>Akil Wood</td>
<td>India, China, Indonesia</td>
<td>Mouth freshner, aphrodisiac, astringent, bitter, cardiotonic, stimulant, carminative, fragrant</td>
<td>Aromatic oil</td>
<td>Antimicrobial</td>
<td>(61,79, 118)</td>
</tr>
<tr>
<td><em>Lawsonia inermis</em> L.,* Lythraceae</td>
<td>Alavanam Seed</td>
<td>Eastern Ghats, Assam, China</td>
<td>Treatment of headache, hemianrias, lumbago, bronchitis, syphilis, scabies, dysuria, skin diseases</td>
<td>Lawsone, scopoletin, esculetin</td>
<td>Insecticide, antioxidant</td>
<td>(55,63, 119)</td>
</tr>
</tbody>
</table>
Studies regarding the fumigation effect of these herbs were not found on any of the search engines. However, scientific studies suggest the presence of bioactives that may provide sanitization and air-purifying effects on fumigation. Hence, these herbs provide a rationale for future research.

<table>
<thead>
<tr>
<th>Botanical name and family</th>
<th>Siddha name</th>
<th>Part used</th>
<th>Location</th>
<th>Traditional uses</th>
<th>Major Pharmacological action</th>
<th>Siddha Formulation</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ruta chalepensis L., Rutaceae</td>
<td>Aruvatha</td>
<td>Leaves</td>
<td>Kerala, China, North Africa</td>
<td>Anti-inflammatory, analgesic, antipyretic</td>
<td>Chalepin, graveolone, arborinine</td>
<td>Insecticide, fumigant</td>
<td>(66,120)</td>
</tr>
<tr>
<td>Justicia adhatoda L., Acanthaceae</td>
<td>Adathodaai</td>
<td>Leaves</td>
<td>Eastern Ghats, Assam, Himalayas, China, Nepal</td>
<td>Cough, fever, asthma, dysentery</td>
<td>Vasicine, Vasicinone, β-Sitosterol</td>
<td>Fumigation, antioxidant</td>
<td>(55,121)</td>
</tr>
<tr>
<td>Madhuca longifolia (L. König) J.F. Macbr., Sapotaceae</td>
<td>Illupai</td>
<td>Crushed cake of seed</td>
<td>Madhya Pradesh, Eastern Ghats</td>
<td>Emollient, skin diseases, rheumatism, headache, laxative, piles, hemorrhoids</td>
<td>A-Spinnersterol, Betulinic acid</td>
<td>Fumigation</td>
<td>(51,68, 122)</td>
</tr>
<tr>
<td>Datura metel L.,* Solanaceae</td>
<td>Oomathi</td>
<td>Leaves</td>
<td>Haryana, Jammu and Kashmir, Brazil</td>
<td>Anti-fungal, anti-bacterial, anti-inflammatory,</td>
<td>Daturine</td>
<td>Antifungal, antimicrobial</td>
<td>(58,116, 123)</td>
</tr>
<tr>
<td>Solanum surattense Burm. f.,* Solanaceae</td>
<td>Kandangat hiri</td>
<td>Seed</td>
<td>Himalayas, Pakistan, Malaysia, Southeast Asia</td>
<td>Remedy for inflammatory problems, leprosy, dropsy, cough, hernia, dental caries and swelling</td>
<td>Solasonine Solamargine, esculin</td>
<td>Insecticidal</td>
<td>(61,113, 124)</td>
</tr>
<tr>
<td>Saccharum officinarum L.,* Poaceae</td>
<td>Karumbu</td>
<td>Sugar</td>
<td>Assam, Pakistan, New Guinea, Taiwan, China</td>
<td>Whooping cough, canes for broken bones, catarrh</td>
<td>Apigenin, Orientin, Furolic acid</td>
<td>Insecticidal</td>
<td>(59,63, 125)</td>
</tr>
<tr>
<td>Rhus succedanea L.,* Anacardaceae</td>
<td>Karkadaka singi</td>
<td>Gall</td>
<td>Himalayas, Australia, New Zealand</td>
<td>Antidote, cholagogue, febrifuge, treatment of phthisis</td>
<td>Aromatic oil, Tannins</td>
<td>Insecticidal</td>
<td>(96,126)</td>
</tr>
</tbody>
</table>

*Studies regarding the fumigation effect of these herbs were not found on any of the search engines. However, scientific studies suggest the presence of bioactives that may provide sanitization and air-purifying effects on fumigation. Hence, these herbs provide a rationale for future research.

Table 3: Herbal ingredients used in important Siddha formulations for Kabasuram.
<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Family</th>
<th>Part Used</th>
<th>Place of Origin</th>
<th>Uses</th>
<th>Authors</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plectranthus vettiveroides</td>
<td>(Jacob) N.P. Singh &amp; B.D. Sharma, Lamiaceae</td>
<td>Lamiaceae</td>
<td>Root</td>
<td>South India, Sri Lanka</td>
<td>Deodorant, treatment of headache, diarrhea, fever, hyperdipsia, leprosy, ulcer, nausea, giddiness</td>
<td>Analgesic, anti-inflammatory, antimicrobial</td>
<td>(66,129,130)</td>
</tr>
<tr>
<td>Tragia involucrata L., Euphorbiaceae</td>
<td>Sirukaannchon ri Ver</td>
<td>Euphorbiaceae</td>
<td>Root</td>
<td>Assam, West Bengal, Kerala</td>
<td>Treatment of wounds, scabies, skin infections</td>
<td>Bronchodilator, anti-pyretic, anti-inflammatory</td>
<td>(66,131)</td>
</tr>
<tr>
<td>Cyperus rotundus L., Cyperaceae</td>
<td>Koraikilanku</td>
<td>Cyperaceae</td>
<td>Stem bark</td>
<td>Haryana, Africa, central Europe</td>
<td>Remedy for diarrhea, diabetes, inflammation, malaria, stomach, bowel disorder, fever</td>
<td>Antipyretic, anti-hypertensive</td>
<td>(43,132,133)</td>
</tr>
<tr>
<td>Piper nigrum L., Piperaceae</td>
<td>Milaku</td>
<td>Piperaceae</td>
<td>Seed, Fruit</td>
<td>South India, Vietnam, Brazil</td>
<td>Cough, sinusitis, throat pain, infections, ear ache, gastrointestinal disorders</td>
<td>Antimicrobial, anti-pyretic, anti-inflammatory</td>
<td>(42,88)</td>
</tr>
<tr>
<td>Hygrophila auriculata Schumach., Acanthaceae</td>
<td>Neermulli ver</td>
<td>Acanthaceae</td>
<td>Root</td>
<td>South India, Sri Lanka</td>
<td>Treatment of cough, anal fistula, blood disorders, jaundice, anaemia, dropsy, aplhrodisiac</td>
<td>Haematopoietic, anti-inflammatory</td>
<td>(39,67,134)</td>
</tr>
<tr>
<td>Sida acuta Burm.f., Malvaceae</td>
<td>Vattathiruppi Ver</td>
<td>Malvaceae</td>
<td>Root tuber</td>
<td>Tamil Nadu, Central America</td>
<td>Treatment of fever, skin diseases, diarrhea, dysentery</td>
<td>Antibacterial, antipyretic</td>
<td>(39,135)</td>
</tr>
<tr>
<td>Andrographis paniculata (Burm.f.) Nees., Acanthaceae</td>
<td>Nilavembu</td>
<td>Acanthaceae</td>
<td>Stem, leaves</td>
<td>Eastern Ghats, Sri Lanka, China, United States</td>
<td>Treatment of dyspepsia, influenza, dysentery, malaria, respiratory infections</td>
<td>Immunostimulant, anti-inflammatory</td>
<td>(8,28,44)</td>
</tr>
<tr>
<td>Hedyotis corymbosa (L.) Lam., Rubiaceae</td>
<td>Parpadaakam</td>
<td>Rubiaceae</td>
<td>Whole plant</td>
<td>India, Sri Lanka, East Asia</td>
<td>Antiviral, treatment of acne, hepatitis, eye diseases, skin ailments, bleeding, promotes diuresis</td>
<td>Antimicrobial, antioxidant, immunostimulant</td>
<td>(55,136,137)</td>
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<tr>
<td>Trichosanthes cucumerina L., Curcubitaceae</td>
<td>Peipudol</td>
<td>Curcubitaceae</td>
<td>Gourd</td>
<td>Eastern Ghats, Sri Lanka, Malaysia</td>
<td>Treating headache, alopecia, fever, abdominal tumors, boils, diarrhea, haematurian skin allergy</td>
<td>Anti-inflammatory, antipyretic</td>
<td>Nilavembu, Sarva Sura Kudineer (42,44,55, 61,138)</td>
</tr>
<tr>
<td>Zingiber officinalis Roscoe, Zingiberaceae</td>
<td>Sukku</td>
<td>Zingiberaceae</td>
<td>Rhizome</td>
<td>Kerala, Andhra Pradesh, tropical Asia</td>
<td>Antiemetic, stomachic, expectorant, aphrodisiac</td>
<td>Antipyretic, anti-inflammatory</td>
<td>Nilavembu, Sarva Sura, Visha Sura, Kaba Sura Kudineer (28,39,42, 44)</td>
</tr>
<tr>
<td>Plant Name</td>
<td>Part Used</td>
<td>Country of Origin</td>
<td>Medicinal Uses</td>
<td>Pharmacological Properties</td>
<td>Kudineer Composition</td>
<td>PubMed Reference</td>
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<tr>
<td><em>Vetiveria zizanoides</em> (L.) Nash, Poaceae</td>
<td>Root</td>
<td>India, Senegal, Sri Lanka, Brazil</td>
<td>Cooling agent, tonic, blood purifier, treatment of skin disorders, indigestion, loss of appetite</td>
<td>Antioxidant, anti-inflammatory</td>
<td>Nilavembu, Visha Sura Kudineer</td>
<td>(39,42,129)</td>
<td></td>
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<tr>
<td><em>Hemidesmus indicus</em> (L.) R.Br., Apocynaceae</td>
<td>Nannari ver</td>
<td>Eastern Ghats, China</td>
<td>Demulcent, astringent, diaphoretic, diuretic, tonic, antipyretic, blood purifier, leprosy, bronchitis, syphilis, pruritis, urinary diseases</td>
<td>Anti-inflammatory, antipyretic</td>
<td>Visha Sura Kudineer</td>
<td>(39,55)</td>
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<tr>
<td><em>Justicia adhatoda</em> L., Acanthaceae</td>
<td>Aadathodai</td>
<td>Eastern Ghats, Assam, Himalayas, China, Nepal</td>
<td>Cough, fever, asthma, dysentery</td>
<td>Immunostimulant, antimalarial, antitussive</td>
<td>Sarva Sura, Kaba Sura Kudineer</td>
<td>(55,63,139)</td>
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<tr>
<td><em>Glycyrrhiza glabra</em> L., Fabaceae</td>
<td>Adimaduram</td>
<td>Kerala, China, Central and South Western Asia</td>
<td>Sweetening and flavoring agent, expectorant, anti-tussive agent,</td>
<td>Anti-inflammatory, immunomodulatory</td>
<td>Sarva Sura, Visha Sura Kudineer</td>
<td>(57,66,140)</td>
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<td><em>Aristolochia bracteolata</em> Lam., Aristolochiaceae</td>
<td>Eechuramooli</td>
<td>Nigeria, Ethiopia, India</td>
<td>Prevent seizures, immune booster, treatment of snake bites, intestinal pain, gall bladder pain, arthritis, goit, rheumatism</td>
<td>Antibacterial, anti-inflammatory</td>
<td>Visha Sura Kudineer</td>
<td>(61,66,141)</td>
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<tr>
<td><em>Anacyclus pyrethrumin</em> (L.) Link, Asteraceae</td>
<td>Akkarakaram</td>
<td>Himalayas, Jammu and Kashmir, West Bengal, Spain, North Africa</td>
<td>Aphrodisiac, antidiabetic, antiasthmatic, throat problems, rejuvenant, carminative, diuretic, muscle relaxant</td>
<td>Antipyretic, anti-inflammatory, immunostimulant</td>
<td>Sarva Sura, Kaba Sura Kudineer</td>
<td>(53,93,116)</td>
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<tr>
<td><em>Vitis vinifera</em> L., Vitaceae</td>
<td>Grapes/Plums</td>
<td>Europe, Western Asia</td>
<td>Laxative, purgative, diuretic, aphrodisiac, appetizer, asthmatic, treatment of diarrhea, bleeding.</td>
<td>Antipyretic, anti-inflammatory</td>
<td>Sarva Sura Kudineer</td>
<td>(61,136,142)</td>
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<tr>
<td>Plant Name</td>
<td>Part</td>
<td>Origin</td>
<td>Uses</td>
<td>Medicinal Properties</td>
<td>Reference</td>
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<tr>
<td>Indigofera tinctoria L., Fabaceae</td>
<td>Neeli Root</td>
<td>India, Pakistan, China</td>
<td>Treatment of epilepsy, nervous disorders, asthma, bronchitis, fever, stomach ache, rabies, skin diseases, wounds, sores, ulcers</td>
<td>Immunoprotective, anti-inflammatory</td>
<td>Visha Sura Kudineer (39,61,143)</td>
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<tr>
<td>Syzygium aromaticum (L.) Merr. &amp; L.M. Perry, Myrtaceae</td>
<td>Karampu Fruit</td>
<td>Haryana, China, Indonesia</td>
<td>Anxiolytic, expectorant, antimicrobial, decongestant</td>
<td>Antipyretic, antiviral</td>
<td>Visha Sura Kudineer (39,48)</td>
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<tr>
<td>Phyllanthus niruri L., Phyllanthaceae</td>
<td>Keezhkainelli Whole plant</td>
<td>Central and south India, China, Nigeria, Guam</td>
<td>Treatment of jaundice, gonorrhea, antidiabetic, antiviral, skin ulcers, sores, antiallergic</td>
<td>Antiviral, antipyretic, analgesic</td>
<td>Sarva Sura Kudineer (6,57)</td>
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<td>Costus speciosus (J. Konig) C. Specht, Costaceae</td>
<td>Koddam Root</td>
<td>Nagaland, Assam, Sri Lanka, Malaysia</td>
<td>Astringent, aphrodisiac, purgative, anthelmintic, depurative, febrifuge, expectorant, tonic, stimulant</td>
<td>Antipyretic, anti-inflammatory</td>
<td>Sarva Sura, Kaba Sura Kudineer (63,93,109)</td>
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<tr>
<td>Elettaria cardamomum (L.) Maton, Zingiberaceae</td>
<td>Elam Fruit</td>
<td>India, Nepal, Sri Lanka, Mexico, Tanzania</td>
<td>Culinary uses, remedy for asthma, gum infections, kidney disorders, cataracts, nausea, diarrhoea</td>
<td>Antibacterial, anti-inflammatory</td>
<td>Visha Sura Kudineer (39,59,96)</td>
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<tr>
<td>Azadirachta indica A. Juss., Meliaceae</td>
<td>Vembu Stem bark</td>
<td>India, China, Malaysia, Caribbean, South East Asia</td>
<td>Antibacterial, natural antiseptic, antipyretic</td>
<td>Antibacterial, anti-inflammatory, antiviral</td>
<td>Visha Sura Kudineer (51,55,68)</td>
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<tr>
<td>Smilax chinensis L., Smilacaceae</td>
<td>Parankilanku Stem bark</td>
<td>India, China, Taiwan, Japan</td>
<td>Used as energy tonic, remedy for impotency, seminal disorders, arthritis, syphilis, schizophrenia, epilepsy</td>
<td>Antipyretic</td>
<td>Sarva Sura Kudineer (55,116,144)</td>
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<tr>
<td>Mollugo cerviana (L.) Ser., Molluginaceae</td>
<td>Parpadaakam Aerial part</td>
<td>Rajasthan, south India</td>
<td>Fever, stomach ache, jaundice, gout, rheumatism</td>
<td>Antioxidant, antipyretic, spasmolytic, hypolipidemic</td>
<td>Sarva Sura Kudineer (42,44,145)</td>
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<tr>
<td><strong>Tinospora cordifolia</strong> (Thunb.) Miers, Papilionaceae</td>
<td>Seenthil kodi</td>
<td>Leaves</td>
<td>Haryana, Madhya Pradesh, Assam, China, Bangladesh, Vietnam, Malaysia, Sri Lanka</td>
<td>Memory booster, antispasmodic, antidiarrheal, stomachic, tonic, bronchitis, promotes longevity, anti-allergic</td>
<td>Antimicrobial, antioxidant, anti-inflammatory</td>
<td>Sarva Sura, Kaba Sura Kudineer (57,68,132)</td>
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<tr>
<td><strong>Alpinia galanga</strong> (L.) Willd., Zingiberaceae</td>
<td>Sitrarathai</td>
<td>Rhizome</td>
<td>West Bengal, Assam, Cambodia, Thailand, Japan</td>
<td>Cold, sore throat, anti-emetic, analgesic, antioxidant</td>
<td>Anti-inflammatory</td>
<td>Sarva Sura Kudineer (53,54)</td>
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</tr>
<tr>
<td><strong>Abies webbiana</strong> Lindl., Pinaceae</td>
<td>Talisapathiri</td>
<td>Leaves</td>
<td>Himalayas, Northeast India</td>
<td>Carminative, expectorant, stomachic, tonic, as a remedy for respiratory problems, cold, tuberculosis, indigestion</td>
<td>Anti-tussive, anti-inflammatory</td>
<td>Sarva Sura Kudineer (87,93,146)</td>
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<tr>
<td><strong>Piper longum</strong> L., Piperaceae</td>
<td>Thipally</td>
<td>Root</td>
<td>India, Pakistan, China, Europe</td>
<td>Relieve muscular pains, anti-inflammatory, stimulant, stomachic, antidiabetic</td>
<td>Anti-inflammatory, analgesic</td>
<td>Sarva Sura, Kaba Sura Kudineer (61,66,84)</td>
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<td><strong>Evolvulus alsinooides</strong> (Linn.) Linn., Convolvolaceae</td>
<td>Vishnukiraanthy</td>
<td>Whole plant</td>
<td>Eastern Ghats, Africa, Philippines</td>
<td>Cure fever, cold, venereal diseases, adenitis, depression, dementia</td>
<td>Antipyretic, anti-inflammatory, antidiarrheal</td>
<td>Sarva Sura Kudineer (55,79,131,147)</td>
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<tr>
<td><strong>Clerodendrum serratum</strong> (L.) Moon., Verbenaceae</td>
<td>Siruthekku</td>
<td>Root</td>
<td>Assam, Himalayas, Sri Lanka, South Africa, Australia</td>
<td>Remedy for cough, asthma, malaria, fever, urinary tract infections, itching, ulcerated wounds, dysmenorrheal epilepsy</td>
<td>Anti-allergic, antipyretic, anti-inflammatory</td>
<td>Visha Sura Kudineer (59,148,149)</td>
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</tbody>
</table>

**References**

7. Jain J, Pai S, Sunil S. Standardization of in vitro assays to evaluate the activity of polyherbal siddha...


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