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A REVIEW ON POLYHERBAL SIDDHA FORMULATION OF SURA KASHAYAM FOR COVID-19

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ABSTRACT

Many dreadful viral fevers have been reported recently in India and other Asian countries. COVID-19 is an emerging viral infection that is a present global public health problem. Due to the nature of respiratory virus, the transmission of this pathogenic virus is droplet. Hence, the rapid spreading and difficulty in control of this infection can be expected. The Covid-19 is a human to human spreading disease and easily clamps human through droplets generated when an infected person coughs or sneezes or through droplets of saliva or discharge from the nose. Covid-19 is an infectious disease caused by Severe Acute Respiratory Syndrome coronavirus-2. Siddha medicine is one of the oldest medical systems in the world. The ancient Siddha medicine proposes that the balance in three thoshangal (vadham, pitham, kabam) is essential for the body health. If any vitiation of these, it will cause diseases. Sura Kashayam is a polyherbal combination which is indicated in the Siddha literature Sigicha Rathna Deepam for the treatment of 64 types of fever. Therapeutic property of every plant is confined to the bioactive compounds present in it. The Polyherbal ingredients of the Sura Kashayam possess anti-pyretic, anti-viral, anti-inflammatory, anti-microbial, analgesic and anti-oxidant activities. The effects of the various phytochemicals present in sura kashayam will help in suppressing and curing the clinical symptoms associated with COVID-19.

KEY WORDS: ***Sura Kashayam, anti-viral, 64 types of fever, Siddha medicine***

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1. Introduction

COVID-19, or more popularly known as Novel Corona Virus, is associated with the respiratory disorder in humans which has been declared as a global epidemic and pandemic in the first quarter of the year 2020 by the World Health Organization [1] Coronavirus disease 2019 (COVID-19) is spreading rapidly throughout the world and is infecting people irrespective of their age, gender and ethnicity.[2]

Coronaviruses (CoVs), are the family of viruses that have pricky spikes that project from their surface. They have enveloped RNA viruses, are characterized by club-like spikes that project from their surface, and they have a unique replicating process. These viruses are the cause of many types of diseases in mammals and birds leading to enteritis in cows and pigs and upper respiratory infection in humans which may be fatal [3]

Globally there are 13,235,750 cases and 575525 deaths from COVID-19 virus in the present day. Coronaviruses are a large family of viruses which may cause disease in animals or humans. Seven coronaviruses can produce infection in people around the world but commonly people get infected with these four human coronaviruses: 229E, NL63, OC43, and HKU1. They usually cause a respiratory infection ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS) and the most recently discovered coronavirus (COVID-19) causes infectious disease. [4]

Older age people and younger adults with serious illness, such as diabetes, heart disease, and lungs disease, have a greater risk of becoming severely ill if they get infected with the coronavirus. The virus that causes coronavirus disease 19 (COVID-19) is a highly transmittable and pathogenic viral infection and mainly transmitted through contact with respiratory droplets rather than through the air.[5]

Primarily people can catch coronavirus disease 19 (COVID-19) from others who are infected. A single cough can circulate up to 3.000 droplets. These droplets can land on other people, and covering surfaces around them, however, several smaller particles will stay within the air. The virus is also shed for extended in faecal matter, thus anyone who are not washing their hands thoroughly after visiting the toilet, bathroom could contaminate anything they touch. Like many respiratory viruses, including flu, Covid-19 can be spread by close contact with small droplets released from infected individuals' upper respiratory tract secretions e.g. sneezing, common cold or coughing from the nose and mouth. [6]

This disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The virus typically rapidly spread from one person to another via respiratory droplets produced during coughing and sneezing. It is considered most contagious when people are symptomatic, although transmission may be possible before symptoms show in patients. Time from exposure and symptom onset is generally between two and 14 days, with an average of five days. Common symptoms include fever, cough, sneezing and shortness of breath,diarrhea nasal congestion, runny nose, sore throat or diarrhea. Complications may include pneumonia, throat pain and acute respiratory distress syndrome. Currently, there is no specific antiviral treatment or vaccine; efforts consist of symptom abolition supportive therapy. [7]

The standard tool of diagnosis is by reverse transcriptionpolymerase chain reaction (rRT-PCR) from a throat swab or nasopharyngeal swab. The infection can also be diagnosed from a combination of symptoms, risk factors and a chest CT scan showing features of pneumonia.[8] There is no specific antiviral treatment available in the modern medicine system to treat COVID-19.

Plants, being a reservoir of medicinal compounds, help in preventing and curing ailments without serious adverse effects. Plants produce phytochemical constituents for defense against pathogen owing to their characteristic bioactivities. Therapeutic property of every plant is confined to the bioactive compounds present in it. Siddha is the world’s oldest medical system that can manage any disease without side effects, with several polyherbal therapies which were formulated based on Siddha principles. Siddha is equipped with varieties of treatment modalities to handle with any type of deadly diseases. Diagnosis in this system includes assessing the equilibrium and derangement of the three thoshangal of the body - Vatham, Pitham and Kapam, the imbalance of which is believed to be the

cause of various disease.The drug Sura Kashayam has been quoted for 64 types of fever, the symptoms of which is an analogue with COVID-19, mentioned in Sigicha Rathna Deepam. The motto of this work is to screen the herbal ingredients of siddha drug Sura Kashayam to evaluate its effectiveness towards the management of COVID-19.

Ingredients of Sura Kashayam

Korai kilangu (Cyperus rotundus) -17.5g
Akkrakaram (Anacyclus pyrethrum) -17.5g
Adhi mathuram (Glycyrrhiza glabra) -17.5g
Kostam (Costus speciosus) -17.5g
Elam (Elettaria cardamomum) -17.5g
Lavangam (Syzygium aromaticum) -17.5g
Kodiveli (Plumbago zeylanica) -17.5g
Chukku (Zingiber officinale) -17.5g
Milagu (Piper nigrum) -17.5g
Thippili (Piper longum) -17.5g
Kadukkai (Terminalia chebula) -17.5g
Nelli vatral (Phyllanthus emblica) -17.5g
Thantrikai (Terminalia bellerica) -17.5g
Vetpalai (Wrightia tinctoria)- -17.5g
seeragam (Cuminum cyminum) -17.5g
Karunseeragam (Nigella sativa) - -17.5g

Preparation of Sura Kashayam

Black pepper should be fried and then powdered into ash form. Two different types of cumin seeds are fried until a crackling noise is heard. 2 litre(2000ml) of water should be boiled to its boiling point. The other ingredients of the medicine are also grounded into small pieces. To the boilng water all the above grounded ingredients along with black pepper and karunseeragam are added. The decoction is prepared by reducing to 500ml of its quantity. The prepared decoction is prescribed for three consecutive days, three times daily. It is indicated for 64 types of fever and thirst.

Pharmacological Evaluation of Drugs of Sura kashayam

1.Cuminum cyminum:

Anti viral activity:

The essential oils of cuminum cyminum showed antivial activities against herpes Simplex virus (HSV-1) using cytopathicity (CPE) assay.[25] Cumin seed extract of EHP[1-(2-Ethyl, 6-Heptyl) Phenol] against Cox B4, HSV and HAV[26]

Immunomodulatory

Oral treatment with cumin showed immunomodulatory properties in normal and immune-suppressed animals via modulation of T Lymphocytes expression in a dose dependent manner. It stimulated the T cells (CD4 and CD8) and Th1 cytokines-A induced immune suppressed mice.[27]

Anti-inflammatory Activity:

The aqueous and ethanolic extracts of cuminum cyminum extracts (200-500 mg/kg) showed significant anti-inflammatory activity in carrageenan induced paw edema and cotton-pellet granuloma.[28]

2.Nigella sativa

Anti-viral activity:

The oil and seed extract of N. sativa having inhibitory effect on human immune deficiency virus.[29]

Anti-inflammatory Activity:

Aqueous extract of N.sativa exhibit anti-inflammatory and analgesic activity. The anti-inflammatory activity is due to the presence of main constituent of Thymoquinone.[30]

Respiratory effects:

Boiled extract of N.sativa (50 and 100 mg kg) shows bronchodilatory effects.[31]

Immunomodulatory activity:

The methanolic extract of N.sativa increases the total white blood cells (WBC) count as well as bone marrow cellularity. This immunomodulatory effect was evident by increasing the spleen weight of treated rats.[32]

3.Costus speciosus

Antipyretic Activity:

The antipyretic activity was studied against Brewer's yeast-induced pyrexia in rats. The methanolic extract of C.speciosus has significantly reduced the rectal temperature of animals.

Anti-Inflammatory and Analgesic Effect:

The anti-inflammatory effect of the methanolic extract of C.speciosus was assessed using carrageenan- induced paw edema test by injection of 0.1ml of 1%carrageenan in 0.9% saline into subplantar region of the left hind paw. Acetic acid induced writhing and Eddy's hot plate models were used to determine the analgesic effect.[33]

4.Cyperus rotundus

Anti-pyretic Activity:

The alcoholic extract of Cyperus rotundus shown highly significant (P<0.001) Antipyretic action against pyrexia produced in albino rats by the subcutaneous injection of suspension of dried Brewer's yeast in gum acacia in normal saline.[34]

Anti-Inflammatory Activity:

The methanol, chloroform and ethyl acetate extract of C.rotundus rhizomes shown the anti inflammatory activity at dose of 500mg /kg carrageenan induced paw edema in animal.[35]

Anti-malarial activity:

Cyperus rotundus rhizomes showed in vitro anti malarial activity against Plasmodium falciparum. Sesquterpene was identified as active principle.[36]

5.Glycerrhiza glabra:

Immuno-stimulatory effects:

In vitro studies proved that G.glabra at 100µg/ml concentration possess immunostimulatory effects. It increases production of TCD69 lymphocytes and macrophages from human granulocytes. Liquous root extract was found to prevent the rise in the amount of immune-complexes related to autoimmune diseases like systemic lupus erythematous.

Anti-viral Activity:

Glycerrhizin inhibits in vitro growth of a number of viruses, including human immunodeficiency viruses.It has been suggested that glycyrrhizin has an affect on viral growth, possibly through an inhibition of viral particle to cell membrane binding, replication mechanisms, or through cellular transduction mechanisms. [38]Glycyrrhizin has been reported as the most active in inhibiting replication of the severe acute respiratory system (SARS) associated coronavirus.[39]Glycyrrhizin had antiviral activity against HIV-1, SARS related coronavirus, respiratory syncytial virus, arboviruses, vaccinia virus and vesicular stomatitis virus. They have summarized the mechanisms for antiviral activity of Glycyrrhiza glabra as reduced transport to the membrane and sialylation of hepatitis B virus surface antigen, reduction of membrane fluidity leading to inhibition of fusion of the viral membrane of HIV-1 with the cell, induction of interferon gamma in T- cells, inhibition of phosphorylating enzymes in vesicular stomatitis virus infection and reduction of viral latency.[40]

Anti Inflammatory Activity:

The anti-inflammatory effect of hydro alcoholic G.glabra root extract against carrageenan induced rat paw and they revealed that hydro alcoholic G.glabra extract prevented leucocyte migration in a dose dependent manner.[41]

Effect on Respiratory system:

Glycyrrhiza decresed irritations in the throat and produced expectorant effects. It was assumed that Glycyrrhiza was able to stimulate tracheal mucus secretions and promote demulcent effects.[42]

6.Anacyclus pyrethrum:

Immuno-stimulating Activity:

Hot water Polysaccharide extracts of Anacyclus pyrethrum was tested for their immune stimulating activity in mice. It showed a marked stimulating activity on the reticuloendothelial system(RES) and increased the number of peritoneal exudates cells (PEC) and spleen cells of mice.[43]

Antipyretic Activity:

Antipyretic activity of Anacyclus pyrethrum was evaluated in yeast induced pyrexia in rats at a dose of 100mg/kg i.p. and was observed to possess significant anti-pyretic activity. The activity was very comparable to standard drug Paracetomal 150mg/kg i.p. A.pyrethrum showed a effective antipyretic activity.[44]

Anti-inflammatory activity:

The anti-inflammatory activities of higenamine (a plant-based alkaloid) were evaluated by measuring paw edema. It was found to possess significant anti-inflammatory activity in the dose range of 10-15mg/kg.[45]

7.Terminalia bellirica:

Anti-pyretic activity:

The ethanolic and aqueous extracts of Terminalia bellirica fruits (200mg/kg, p.o.) was studied in brewer's yeast-induced fever models in mice and rats. T.bellerica extracts showed a significant inhibition of elevated body temperature.[46]

Immunomodulatory activity:

T.bellerica fruit extracts possess immunomodulatory activity which was studied by phagocytic and lymphocyte proliferation activity of fruit methanolic extract on the mouse. T.bellerica extract reported to stimulate the production of superoxide anions and acid phosphatase and hence promotes macrophage phagocytosis.[47]

Bronchodilatory activity:

The crude extract of Terminalia belerica fruits elicited the relaxation of CCh-induced contractions on guinea-pig trachea.[48]

8.Terminalia chebula:

Anti-viral Activity:

Hot water extracts of T.chebula fruit were studied for anticytomegalovirus activity.T.chebula extract showed a significant inhibition of the replication of human cytomegalovirus growth.[49]

Anti-inflammatory activity:

Anti-inflammatory activity studied that chebulanin isolated from T.chebula suppresses the expression of inflammatory mediators and prevents cartilage destruction and bone erosion in mice.[50]

Anti-HIV Activity:

The crude extract of T.chebula and gallic acid showed dose-dependent inhibition on different HIV-1 Strains Such as HIV-1 92 HT599, NARI-VB 39,NARI-VB 49, NARI-VB 28 , NARI-VB 29, NARI-VB 30.[51]

Immuno modulatory activity:

Aqueous extract of T.chebula produced an increase in humoral antibody titre and delayed type hypersensitivity in mice. Crude extract of T.chebula stimulated cell-mediated immune response in experimental amoebic liver abscess in golden hamsters.[52]

9.Phyllanthus emblica:

Anti-pyretic activity:

The ethanol and aqueous extracts of E.officinalis fruits at a single dose of 500mg/kg caused a significant lowering in rectal temperature of hyperthermic rats.[53]

Anti-microbial activity:

Aqueous infusion extract of P.emblica exhibited potent antimicrobial activity against Enterobacter cloaca ,E.coli, Klebsiella pneumonia.[54]Aqueous infusion and decoction of P.emblica exhibited strong antibacterial activity against Proteus mirabilis, Pseudomonas aeruginosa, S.typhi,S.paratyphi A, S.paratyphi B, and Serratia Marcescens.[55] I,2,4,6-tetra-O-galloyl -O-galloyl –β-D-glucose containing P.emblica was reported for anti-viral activity against anti-herpes simplex virus in vitro.[56]

Immuno modulatory activity:

Immuno modulatory effect of P.emblica on immune profile of tumor bearing mice. When administered orally, P.emblica fruit powder was found to enhance NK cell activity and antibody dependent cellular cytotoxicity (ADCC) in synergic Balb/c mice bearing Dalton's lymphoma ascites tumor.[57]

10.Zingiber officinale

Antibacterial activity:

The ethanolic extract of Z.officinale showed marked antibacterial activity against E.coli and Shigella in a dose dependent manner. E.coli and Shigella were also more susceptible to the ginger extracts while Klebsiella was the least susceptible.The antibacterial activities of the extracts are perhaps due to present of bioactive compounds like Alkaloid, Terpenoid, Saponin, Tannin, flavonoids and Anthraquinones.[58]

Antipyretic activity:

The aqueous extract of Z.officinale rhizome exhibited effective anti pyretic activity against Brewer's yeast induced pyrexia in rat models in a dose dependent manner.[59]

Anti-microbial activity:

The tested ethanolic extract of ginger showed marked antibacterial activity against Staphylococcus aureus and Enterococcus feacalis. The strongest inhibition activity of the ginger extract was observed against staphylococcus aureus and Enterococcus feacalis, it is clear that the ethanolic extract of ginger is more efficient in gram positive organisms.[60]

Anti-viral Activity:

In plaque reduction test, the dried rhizome of ginger studied for anti-rhino-viral activity. Fractionation by solvent extraction, solvent partition and repeated chromatography guided by bioassay, allowed the isolated several sesquiterpenes with anti-rhino-viral activity. The most effective acivity of these was β-sesquiphellandrene [61]

Immune modulatory activity:

Higher hemagglutinating antibody titre and plaque forming cell counts, consistent with improved humoral immunity, found in mice fed a 50% ethanolic ginger extract (25mg/kg) for seven days[62] Aqueous ginger extract significantly increased the production of IL-1β, IL-6 and TNF-α in activated peritoneal mouse macrophages and splenocyte proliferation and cytokine production.[63]

11.Piper nigrum:

Antipyretic activity:

The antipyretic activity of piperine was observed by using yeast-induced pyrexia in mice. The rectal temperature was measured in piperine (20 and 30

mg/kg) treated mice as compared to control group. Where the significant ($p<0.5$) increase in temperature in the control group mice was observed.[64]

Anti-inflammatory activity:

Anti-inflammatory activity was studied that piperine at 2.5, 5 and 10µg/ml concentration inhibited the collagen matrix invasion of B16F-10 melanoma cells in a dose dependent manner. It also significantly reduced the proinflammatory cytokines.(such as IL-1β,IL-6,TNF-α, GM-CSF).[65]

Immunomodulatory activity:

In vitro study immunmodulatory activity of piperine was evaluated to enhance the efficacy of rifampicin in a murine model of Mycobacterium tuberculosis infection. Piperine treated mouse splenocytes demonstrated an increase in the secretion of Th-1 cytokines (IFN-γ and IL-2), increased macrophage activation and proliferation of T and B cell. Protective efficacy of piperine and rifampicin (1 mg/kg) combination against Mycobacterium tuberculosis was reported due to immuno-modulatory activity.[66]

12.Piper longum

Anti-Viral Acticity

The fruits of P. longum has tonic and anti-viral property which increases total WBC count, bone marrow cellularity and total antibody production.[67] Pipemic acid of P. longum exhibits immunomodulatory and antiinflammatory activities by suppressing the pro-inflammatory cytokines. It can also act as a bio-enhancer and anti-tumor agent.[68]

Antioxidant activity

Extract was subjected to free radical scavenging activity. In this investigation, the leaves extract showed free radical scavenging activity (IC50=149.42 µg/ml) while ascorbic acid was 25.42 µg/ml.

Antibacterial activity

The extract showed good activity against Staphylococcus aureus and Salmonella typhi at different doses but reduced activity against Bacillus subtilis, Salmonella paratyphi and Shigella dysenteriae and mild activity against Escherichia coli.[69]

Anti-inflammatory

The Piper longum extracts of piperine have inhibitory activities on prostaglandin and leukotrienes COX-1 inhibitory effect and thus exhibit anti-inflammatory activity.[70]

Anti-asthmatic activity:

An extract of the fruits in milk reduced passive cutaneous anaphylaxis in rats and protected guinea pigs against antigen-induced bronchospasm.[71]

12.Elettaria cardamomum

Immunomodulatory activity:

Cardamom contains monoterpenes 1,8-cineol which were reported to stimulate immune response through increased phagocytic ability of macrophages.[72]

Anti-inflammatory activity:

Elettaria cardamomum Seed oil (175µl/kg and 280µl/kg) showed significant antiinflammatory activity in carageenan induced rat paw edema.[73]

Antimicrobial activity

The acetone, ethanol and methanol extracts of the Elettaria cardamomum fruits extracts were studied antimicrobial activity against Streptococcus mutans, Staphylococcus aureus, Lactobacillus acidophilus, Candida albicans andaccharomyces cerevisiae.[74]

13.Syzygium aromaticum

Anti-pyretic effect:

The antipyretic effect of clove oil is shown due to the presence of the major chemical constituent Eugenol, when administered intravenously, intragastrically and centrally to rabbits which are made febrile by interleukin-1. The effect was shown primarily by acting centrally similar to that of common anti-pyretic drugs, such as acetaminophen and was more effective in reducing fever than acetaminophen. [75]

Antiviral activity:

Eugenin isolated from clove buds showed antiviral activity against Herpes Simplex virus at a concentration of 10 µg /ml.[76]

Anti-inflammatory activity:

he Syzygium aromaticum extracts showed a significant anti inflammatory activity. This activities are due to presence of major components of flavanoids including kaempferil, rhamnetin, and β-caryophyllene.[77]

Antibacterial activity

The antibacterial activities of ethanolic extracts of Syzygium aromaticum studied against E. coli and E. coli and Shigella. The antibacterial activities of the extracts are expected perhaps due to the present of major bioactive compounds like Alkaloid, Terpenoid,

Saponin, Tannin, flavonoids and Anthraquinones which were dissolved in the solvents.[78]

14.Plumbago zeylanica-

Antiviral Activity

The antiviral activities of the 80% methanolic extracts of Plumbago zeylanica against Coxsackie Virus B3 (CVB3), influenza A virus and herpessimplex virus type 1 (HSV-1) was confirmed by plaque reduction assays. [79]

Antibacterial Activity

The aqueous extract and its partition (Petroleum ether, dichloromethane, methanol, aqueous residue) were effective against Salmonella gallinarum, Escherichia coli, Proteus vulgaris, Salmonella typhimurium, Pseudomonas aeruginosa and Staphylococcus aureus. The alcoholic extract from roots of Plumbago zeylanica was tested against multi-drug resistant of clinical origin (Salmonella paratyphi, Staphylococcus aureus, Escherichia coli and Shigella dysenteriae). The extract exhibited strong antibacterial activity against all tested bacteria. Plumbagin augments and macrophage bactericidal activity by potentiating the Oxyradical release at low concentration, whereas at the higher concentration it has inhibitory activity in BALB/C mice.[80]

Immunomodulatory activity

The alcohol extracts of Plumbago zeylanica showed significant immunomodulatory (immunostimulant) activity determined by rat paw oedema test and macrophage clearance phagocytic index.[81]

Anti HIV and Anti-oxidant activity

The different solvent extract of wrightia tinctoria leaves showed potent anti HIV activity on mock infected MT-4 cells. The ethanolic extract of Wrightia tinctoria flower showed potent antioxidant activity on DPPH free radicals, potent antibacterial activity on bacterial strains like staphylococcus aureus.[82]

2.Conclusion

The review of Poly herbal formulation of Sura kashayam also highlighted the pharmacognostical, chemical constituent and pharmacological properties details of the drug and explained about the Siddha concept of herbal properties along with emphasis on the Antiviral, antipyretic, immunomodulator, Anti microbial, Analgesic, Anti-oxidant and Anti malarial properties of various herbs used in this formulation. This Sura Kashayam formulation has not been studied for its synergistic pharmacological activities. It is the further need of time to complete pharmacological and clinical studies to protect people from the deadly disease COVID-19. The effects of the various phytochemicals present in Sura kashayam will help in suppressing and curing the clinical symptoms associated with COVID-19.

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Table 1: Chemical Constituents of Sura Kashayam

1.Phyllanthus emblica	Nelli vatral	Vitamin C, Phosphatides,essential oils, tannins, minerals, vitamins, aminoacids,fattyacids, glycosides,Beta carotene, chebulic acid,cysteine,glycine, Valine,linoleic, stearic and palmiticacids,thiamine,threonine.[9]
2.**Terminalia bellerica**	Thandrikai	Glycosides, flavanoids, tannins, phenols, saponin, carbohydrates, proteins, Gallic acid, ellagic acid, chebulagic acid, Argungenin, belleric acid, cannogenol, Tannin, glucose, galactose, Beta sitosterol.[10]
3.**Nigella sativa**	Karunseeragam	carvacrol, carvone, nigellicine, nigellicimine stigmastanol, Thymoquinone,saponin, linoleic acid,tannin, thymol, resin,stigmastanol,nigellone,glycoside.[11]
4.Cuminum cyminum	seeragam	cumin aldehyde, Ephedrine,,Butyl tetradecenoate,Tapentadol,q-cymene,c-terpinene, Benzene, Steraryltrimethylammonium chloride, Phosphorothioic acid,Quinolin-2(1H)-one, O-acetyloxime.[12]
5.**Wrightia tinctoria**	Vetpalai	cycloartenone, cycloeucalenol, wrightial amyrin, ursolic acid, olianolic acid, sitosterol.[13]
6.**Anacyclus pyrethrum**	Akkrakaram	Pellitorine, Sesamine, Anacyclin, Inulin,2-phenyl ethyl amine, tannin, polyacetylenic amides, flavanoids, coumarins, alkaloids.[14]
7.**Terminalia chebula**	Kadukkai	Ellagic acid, chebulinic acid, anthraquinones, polyphenols, galloylglucose, corilagin, terflavin A, punicalagin, triterpinemaslinic acid, chebulagic acid, gallic acid, chebulanin, Ellagic Acid,casuarinin, Terchebulin.[15]
8.**Plumbago zeylanica**:	Kodivelli	2 new quinines, zeylanone, plumbagic acid, isozeylanone, Plumbagin, B-sitosterol, vanilic acid, steroidal glycoside[16]

9.**Syzygium aromaticum**	Kirambu	Eugenol, B-Caryophyllene, Vanillin, Crategolic acid, Kaempferol, Rhamnetin, Eugenitin, Eugenin, Ellagic acid.[17]
10.**Elettaria cardamomum**	Elam	cineole, linalool,terpinyl acetate, d-limonene, alpha- terpineol, alpha and beta pinenes, terpene-4-ol,geraniol, geranyl acetate, linalylactate, sabinene, methyl heptanone, myrcene and alpha terpinene.[18]
11.**Cyperus rotundus**	Korai kilangu	B-Sitosterol, flavanoids, tannins, 3-hydroxy-4-methoxy-benzoic acid, galloylquinic acid, ferulic acid, quercetin, luteolin, afzelechin, catechin, cyclopentane, flavanoids, saponin.[19]
12.**Glycyrrhiza glabra**	Athimathuram	liquirtin, isoliquertin, glycyrrhizin, glycyrrhetic acid, licorice,Asparagine, Benzoic Acid, Licoriphenone, 2-methyliso-flavones, coumarin, terpinen-4-ol, tetramethyl pyrazine, Carbenxolene.[20]
13.**Costus speciosus**	Kostam	B-amyrin, Camphene, Costunolide, Diosgenin, Zerumbone, Lupeol, alpha-Humulene, Eremanthin, B- Sitosterol.[21]
14. **Piper longum**	Thipili	Alkaloids- Cepharadione A, Cepharanone B, aristolactum A 11 norcepharadione B and 2 hydroxy 1 methoxy 4 H dibenzoquinone-4,5 (6H)dione, lignins Piperine, piplartine, piperenonaline pipercide, B-sitosterol dihydrostigmasterol, L-tyrosine, L-cysteine, hydrochloride L-aspartic acid ,palmitic, hexadecenoic stearic linoleic oleic linolenic high saturated acids arachidic and L-tyrosine.[22]
15.**Piper nigrum**	Milagu	Piperonal (2E,4E)-N-isobutyl-2,4-decadienamide (Compend of Ind medicinal Plant) Piperine, Piperanine ,piperettine, piperylin A, piperolein B, pipericine, flavanoids, alkaloids, phenolic amides.[23]

16. **Zingiber officinale**	Chukku	Dry ginger rhizome- Monoterpenoids(B-phellandrene, camphene,cineole, geraniol, curcumene, citral, terphineol, borneol, cineole, geranyl acetate,limonene,linalool) and sesquiterpenoids[alpha-Zingiberene(30-70%), B-sesquiphellandrene(15-20%),B-bisabolene(10-15%), alpha-farnesene,zingiberol]. The powdered rhizome contains 3-6% fatty oil, 9% protein,60-70% carbohydrates, 3-8% crude fiber, 2-3% volatile oil.[24]

Table 2: Description of the ingredients of Sura Kashayam with the taste of each drug, its five element perspective, parts used and actions of drug

S.No	Name of the Drug	Taste	Pancha bootham	Parts used	Actions
1	Cyperus rotundus (Korai kilangu)	…	…	Rhizome	Astringent Diaphoretic Demulcent Tonic
2	Anacyclus pyrethrum (Akkrakaram)	Acrid	Fire +Air	Root	Stimulant Rubefacient Sialogogue
3	Glycerrhiza glabra (Adhi mathuram)	Sweet	Earth + Water	Root	Tonic Emollient Laxative Mild expectorent
4	Costus speciosus (Kottam)	Bitter	Air+ Space	Root	Stomachic Expectorent Tonic Stimulant Diaphoretic
5	Elettaria cardamomum (Elam)	Acrid	Fire +Air	Fruit	Stimulant Carminative Stomachic
6	Syzygium aromaticum (Lavangam)	Acrid	Fire +Air	Bud	Carminative Stomachic Antispasmodic
7	Plumbago zeylanica (Kodiveli)	Acrid	Fire +Air	Root	Appetizer Antiseptic
8	Zingiber officinale (Chukku)	Acrid	Fire +Air	Rhizome	Stimulant Carminative

9	Piper nigrum (Milagu)	Bitter Acrid	Air+ Space Fire +Air	Seed	Stomachic Stimulant Carminative Antivatha Antidote Antiperiodic
10	Piper longum (Thippili)	Sweet	Earth + Water	Fruit	Stimulant Carminative
11	Terminalia chebula (Kadukkai)	Acrid	Fire +Air	Seed layer	Astringent Stomachic Tonic
12	Phyllanthus emblica (Nelli)	Sour Astringent Sweet	Earth+ Fire Earth+ Space Earth + Water	Dried fruit	Astringent
13	Terminalia bellirica (Thantri)	Astringent	Earth+ Space	Seed Layer	Astringent Expectorent Tonic Laxative
14	Wrightia tinctoria (Vetpalai)	Sweet	Earth + Water	Seed	Tonic
15	Cuminum cyminum (Seeragam)	Acrid Sweet	Fire +Air Earth + Water	Seed	Stimulant Carminative Stomachic Astringent
16	Nigella sativa (Karunseeragam)	Bitter	Air+ Space	Seed	Carminative Stomachic Parasiticide Emollient