



COVID conundrum: Possible solutions in Ayurveda

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In spite of several advances in healthcare, viruses are emerging and re-emerging as one of the significant reasons for morbidity and mortality on the planet. Currently, COVID-19 has arisen as the most fierce and affright viral infection to be handled by the human race, due to its nature of fast acceleration and slow deceleration. Neither vaccines nor drugs are currently available for prevention, prophylaxis and treatment of SARS-CoV2 infection in humans. Ayurveda, being the “science of holistic living and art of natural healing”, could offer potential solutions for the prevention and management of COVID-19 infection. In this article, an attempt to find possible solutions by analysing the disease profile of COVID-19 using ayurvedic framework is made. *Trividha bodhya sangraham* is the guiding tool to analyse *anukta vyadhi* (novel or unsaid diseases). Different six levels of care i.e., preservation, promotion, protection, adjuvant/add-on, stand-alone and supportive recipes may be applied on case-to-case basis. Ayurveda based broad-spectrum antiviral agents could give extra assurance for everybody from novel viral diseases, reinforcing to leverage the potentials of Ayurveda. ‘NAMASTE’ is an acronym introduced to signify the protective measures of corona infection.

Keywords: *Anukta vyadhi*, Ayurveda, COVID, *Janapadodwamsa*, *NAMASTE*

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Currently, world is facing burden of dual NCDs, one is non-communicable diseases such as Diabetes mellitus, Hypertension, COPD etc. and other one is novel communicable diseases such as SARS-CoV, SARS-CoV2, Zika, Ebola, Nipah virus etc. Similarly we are also being effected with globalization, one aspect is ‘Globalization of diseases’ (as the present condition COVID-19 effected almost all the countries in the world) and other aspect is ‘Diseases of Globalization’ may be due to mixing of cross cultural habits, foods, products etc. which has led to increased incidence and prevalence of diabetes, hypertension, cancer etc.

Ayurveda is the indigenous system of healthcare developed in India with a method of reasoning legitimate establishment and it has made due as an unmistakable element from distant artifact to the current day¹. The basics on which the Ayurvedic framework is based are valid for all times and eternal; contrarily Aristotle’s humoral theory is obsolete in modern medicine. Though Ayurveda is ancient in origin, but is so advanced in addressing the contemporary public health issues under the heading of ‘*janapadodwamsa*’.

Janapadodwamsa (Pestilence-Devastating epidemics)

Despite the individual dissimilarities in *Prakriti*, *Ahara*, *Bala*, *Sathmya*, *Manas* and *Ayu*; *Vayu* (Air), *Udaka* (Water), *Desa* (Geographical location) and *Kala* (Seasons) are the four major factors that are common for all inhabitants. These four factors, when polluted, affect all human beings simultaneously and results in ecological imbalance and causes Epidemics². In a correspondence article published in Lancet journal, Wind (*Vayu* according to Ayurveda) was emphasized as a disregarded factor in the spread of irresistible illnesses. They demonstrated that breeze ought to be considered as a pivotal factor in the transmission of different illnesses, not simply those that are air-borne, on the grounds that it could balance the elements of various vectors and microorganisms³.

As per Charaka, however, individual people vary generally in physical wellbeing and vitality, and they are aggregately at risk to annihilating pandemics brought about by external components. Punarvasu, analysing the root cause of the four fold pollution, says that ultimately human misdeeds of the present life or past life arising out of intellectual blasphemy (*Pragnyaparadha*) are responsible for all types of cosmic pollution and resultant ailments including large scale man slaughters with or without armaments (*tatha sastraprabhavyasya pi janapadodwamsasyadharmasya eva hetur bhavati*)⁴.

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Oupasargika roga (Communicable diseases) - “*Oupasargika roga samsarga jatah*” - The diseases that are believed to occur from contact with affected person are known as *Oupasargika roga*. The different modes of disease transmission from one person to another are mentioned in Ayurveda like *Prasangath* (Sexual route), *Gatra samsparsath* (Direct and indirect body contact –direct physical contact includes hand shaking, kissing, hugging etc. and indirect contact includes touching contaminated surfaces, objects), *Nishwasath* (respiratory droplets and aerosols), *Sahabhajanath* (taking food along with diseased person), *Sahasayasanath* (sitting and sleeping with afflicted person), *Vastramalyanu lepanath* (using the clothes, cosmetics and ornaments of patient). Acharya Sushruta mentioned diseases like *Kushta* (Leprosy and other skin conditions), *Jwara* (Fever of epidemic origin like swine flu, Corona), *Sosha* (Pulmonary tuberculosis), *Netrabhishyanda* (Conjunctivitis) etc., are communicable from one person to another, as examples of *Oupasargika roga*⁵⁶.

Anukta vyadhi

As COVID-19 is a new disease, it is unwise to expect an exact description of the disease in the ancient treatises. Based on the recommendations of Ayurveda with regard to new upcoming diseases i.e., *Trividha bodhya sangraha*⁷, the Ayurvedic literature was reviewed to identify the symptomatology that best describes the current presentation of patients with COVID-19 infection. With specific reference to Ayurveda, the entity, which isn't straightforwardly or explicitly referenced in Ayurvedic texts, is *Anukta*. Examples are diseases like *Phiranga* (Syphilis) and *Upadansha* (Gonorrhoea) are not described in earlier samhita because these diseases may not have existed at that time. However, even these diseases are described in ‘*Bhavaprakash samhita*⁸’ (13th BC) suggesting that they might have existed during the period in which the treatise was recorded.

Concept of ‘*Trividha bodhya sangraha*’ has been described in Charaka Samhita. According to this concept the three entities i.e., *Prakriti*, *Adhishtana* and *Samuttana* need to be taken in to consideration for understanding any new or unknown disease that has not been explained in the samhita and also depicted as Fig. 1. By the application of these three tools, we can get the *buddhatva* (complete knowledge) of *Anuktavyadhi*. *Vikara prakriti* means the involvement of the dosha in samprati of a vyadhi and it should be identified along with the *anshansha kalpana*

(permutations and combinations of doshas). *Adhishtana* is the place in the body where the *doshadushya sammurchana* (accumulation after the amalgamation of vitiated dosha with weak and susceptible tissues) takes place and the disease is manifested. *Samuttana* are the causative factors. *Samuttana* also means disease symptomatology and healing and recovery from sickness.

To begin with, based on the above Ayurvedic principles, the disease profile of COVID 19 was analysed and summarised in Table 1, 2 and 3. Later, formularies that were described in ancient texts to treat such symptoms and for *samprapti vighatana* (to break the vicious cycle of pathophysiology) were reviewed. And finally, based on the wisdom, experience and published evidences, different recipes are suggested.

In *agantuja jwaras*, dosha vitiation happens later and manifests individual independent signs and symptoms based on the cause¹³.

The signs and symptoms of COVID-19 can vary but over the course of the disease, most persons with COVID-19 will experience the symptom. CDC Interim Clinical Guidance for Management of Patients with Confirmed Coronavirus Disease (COVID-19)¹⁴ updated on April 3, 2020 detailed the symptoms (Table 3). Ayurvedic terminology nearly equivalent to symptoms given in parenthesis.

Clinical course - The largest cohort of >44,000 persons with COVID-19 from China showed that illness severity can range from mild to critical¹⁴:

- Mild to moderate (mild symptoms up to mild pneumonia): 81%
- Severe (dyspnea, hypoxia, or >50% lung involvement)

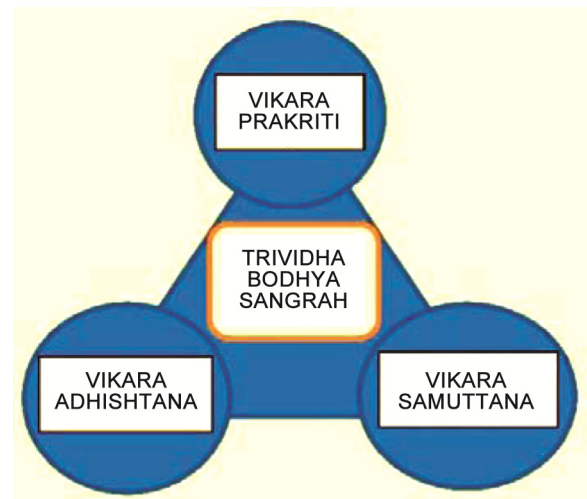


Fig. 1 — Trividhabodhya sangraham

Table 1 — Trividhabodhya sangraham & COVID-19

Vikara Prakriti (disease constitution or template)	Vikara adhisthana (site)	Vikara Samuttana (etiology)
Dosha : Tridosha ⁹ (Pancha vidha vata, Panchavidha pitta and panchavidha kapha) Dushya : Rasa and Rakta Srotas : Pranavaha and Rasavaha srotas mainly Udaka and Annavaha srotas secondarily Srotodushti : Sangam, Atipravritti and Vimarga gamanam Agni : Vishmagni (irregular) Ojas : Para ojas due to involvement of Hridaya – Ojo visramsya, vyapad and Kshaya Rogabala – Pravara (intense) Rogamarga : Abhyantara roga marga Vyadhi swabhava : Ashukari (accelerates very fast) and Chirakari (decelerates much more slowly) ¹⁰ Sadhyasadyatah – Kricchra sadhya (difficult to cure)	Udabhava sthana : Kanta (throat) Vyaktha sthana : Uras (Chest region) - Phuppusa (Lungs)	Direct cause - • Agantuja karana (Bhutabhisangaja ¹¹ – Corona virus) Indirect cause – • Samsargaja (contact)

Table 2 — Shatkriya kala (six stages of samprapthi pathophysiology) of COVID 19

S. No.	Stage of kriyakala	Pathological changes	Remarks
1	Chaya (accumulation)	Viral entry - entry of SARS-CoV 2 into the body either by nasal/oral/eyes	First four stages are falls under Incubation period. Incubation period is longer in kapha dominance, shorter in vata dominance and medium in pitta dominance ¹² .
2	Prakopa (aggravation/exacerbation)	Viral shedding due to virus-host interaction, evades immune system	Mild – moderate stage
3	Prasara (spreading)	Virus endocytosis - entry into the host cells thru' ACE2 receptors and also travels to lower respiratory tract	
4	Sthana samsraya (invasion)	Viral replication leads to expression of milder symptoms (presymptomatic phase – purvarupa)	
5	Vyaktavastha (manifestation)	Immune hyperactivity Virus-host interaction decides the full expression of symptoms	Severe stage
6	Bhedavastha (complications)	Pulmonary destruction leads to respiratory failure, death	Critical stage

Table 3 — Comparative symptomatology of COVID-19

Vikara samuttana (disease symptomatology)	Remarks
Typical symptoms of Covid 19	
<ul style="list-style-type: none"> Fever (Jwara) (83–99%) Cough (Sushka Kasa) (59–82%) Fatigue (Glani) (44–70%) Anorexia (anannabhilasha/Abhikshnamaharam) (40–84%) Shortness of breath (Swasanadi nigraha) (31–40%) Sputum production (Kasa)(28–33%) Myalgias (Angamarda) (11–35%) 	<ul style="list-style-type: none"> Madhayamavega jwara (low grade fever) is the typical feature of Vatakapha dominance Tivra jwara infers pitta dominance Glani symptom infers involvement of ojas¹⁵ particularly in ojoyyapath Angamarda infers the involvement of Rasa dhatu
Atypical symptoms of COVID 19	
<ul style="list-style-type: none"> Headache (shiro rodanam), confusion (sarvendriyahani), rhinorrhea (peenasa), sore throat (sushka kanta), hemoptysis (raktapitta), vomiting and diarrhea (chardi and atisara) Anosmia (gandhanasha) or ageusia (aruchi) In bhutabshangaja jwara varied symptoms are observed¹⁶ 	<ul style="list-style-type: none"> Chardi and atisara are mentioned in Jwara upadrava Tandra (stupor - improper functioning of sense organs – anosmia and ageusia) gives clue of ojoyyapath

on imaging): 14%

- Critical (respiratory failure, shock, or multiorgan system dysfunction): 5%

In laboratory findings, Lymphopenia is the most widely recognized finding in COVID-19 and is seen in 83% of hospitalized patients. Lymphopenia, neutrophilia, raised serum alanine aminotransferase and aspartate aminotransferase levels, raised lactate

dehydrogenase, high CRP, and high ferritin levels might be related with more prominent disease seriousness.

The management of COVID-19 patients rely upon the clinical presentation, necessity for steady consideration, potential danger factors for creating serious infection, and the capacity of the patient to self-confine at home. Patients with hazard factors for

creating serious sickness ought to be observed firmly given the conceivable danger of movement to extreme ailment in the second week after beginning of manifestations. As on date no specific treatment for COVID-19 is approved by FDA. Several clinical trials are underway testing different remedies with in-vitro antiviral action against SARS-CoV-2 and additionally immunomodulatory impacts that may have expected clinical advantage.

Possible solutions in Ayurveda

World Health Organization (WHO) recommended inclusion of traditional medicine and practices in Risk communication and community engagement, Infection prevention and control & case management of COVID-19¹⁷. WHO defined Traditional medicine as “It is the sum total of the knowledge, skill, and practices based on the theories, beliefs, and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness¹⁸. Traditional Chinese Medicine (TCM) was applied in the treatment provided for over 90 percent of the COVID confirmed cases. Three TCM drugs and prescriptions have also been proved effective and were used in the treatment for most patients¹⁹⁻²¹. Ayurveda, Indian traditional healthcare knowledge system, has enjoyed an unbroken tradition of practice in India for thousands of years till now. TCM applied in Corona cases seems to have Ayurveda connection²². Reports from the Indian states support that Ayush system helps quarantined individuals dodge corona virus infections²³.

The prophylactic and therapeutic potential of traditional and complementary medicine systems such as Ayurveda and Yoga is not really being considered during this crisis and global hunt for effective preventive and treatment measures²⁴. Traditional medicines are commonly overlooked in innovative work of contemporary drugs since their translational possibilities are regularly belittled.

Pathogen-Host-Disease triad

While planning the therapeutics, usually pathogen, host and disease are considered as targets either alone or in combination.

1. Pathogen : SARS-CoV 2
2. Host : Human being
3. Disease : symptoms of COVID 19

Pathogen host interaction and interface leads to the expression of the disease specific symptoms. This

pathogen host interaction influences expression of symptoms, which may be mild, moderate, severe or critical.

Different levels of COVID care in Ayurveda

Based on the dictum of Ayurveda i.e. *Swasthasya swasthya rakshanam, aturasya vikara prashamanam*²⁵, the following different levels of care can be offered from Ayurveda for COVID management.

1. Preservation recipes – For the preservation of health of healthy individuals
2. Promotion recipes – For promotion of Ojas/Rogibala/Immunity in healthcare workers and other frontline staff, vulnerable people such as elderly, patients with chronic diseases (DM, HTN, Asthma, COPD etc.), Pregnancy, Lactating mothers, children & Case suspects so as to prevent the disease
3. Protection recipes - For the protection of health of the recovered cases from lingering infection or secondary attacks of reinfection or reactivation of CoVID-19.
4. Adjuvant/Add-on recipes – in the case management as an adjuvant to standard care.
5. Stand-alone/Mono therapy - only ayurvedic recipes shall be given in mild-moderate stages of the COVID-19 so as contain its progression to successive severe stages.
6. Supportive recipes - Post recovery residual issues such as cough, breathing issues, PTSD etc.

Prime Minister Narendra Modi in his address to the nation on April 14, 2020 had recommended Ayurveda guidelines to build the immunity in seven points of action (*saptapadi*) to prevent coronavirus infection²⁶ and also reminded the same on April 26, 2020 in Mann Ki Baat monthly radio programme²⁷.

Generally in the cases of epidemics, we need such drugs which show instant effects. The drugs should possess Rasayana property, Vishaghna property, Bhutaghna property, Pranavaha sroto specificity and then only they can show the fast acting effects in COVID cases.

The following are the different recipes and supportive measures traditionally regarded as safe and effective –

1. *Pratishmarsh nasya* (intranasal application) –The lining of the nose rich in cells with ACE2 receptors and is the site of entry into the body²⁸⁻³⁰. Intranasal application of oil creates lipophilic medium which may inhibit hydrophilic virus. *Anu tailam*³¹ is specifically advised for intranasal application, as the

ingredients of this medicine possess the antimicrobial effects. Plain sesame oil may also be used. It may be applied at preventive and promotive level of care. Science behind the application of sesame oil inside the nasal cavity and its protection against the viruses has been established hypothetically³².

2. *Dhuma nasya* (medicated aerosol therapy) – medicated fumes from smoke of burning medicated herbs taken by nasal route and eliminated by the oral route. It has systemic therapeutic benefits particularly in respiratory problems. This can be used at all the levels of care.
3. *Gandusha* (oil pulling/swishing)³³ – beneficial to maintain good oral hygiene and to avoid the chances of microbial invasion³⁴. *Gandūsha* stimulates the salivary glands to secrete more saliva, which contains a variety of host defence factors such as IgA, IgM antibodies and lysozymes and also balances the pH of the oral cavity³⁵ it acts against micro-organisms by acting as local antibiotic. Plain sesame oil³⁶ or cow's ghee or *Arimedadi tailam*³⁷ can be used for *gandusha*. This can be used at all the levels of care.
4. Lighting of Ghee lamps – It purifies indoor environment due to its *vishagrahadi bhutaghnam* effect or you may use beewax candles (*bhutaghnam*). This can be practiced on regular basis or else during corona season.
5. *Dhupana karma*—this medicated fumigation therapy may be continued throughout the corona season. This may minimise the community transmission due to antimicrobial properties of medicated fumes and smoke.
6. *Muleti* (*Glycyrrhiza glabra* –liquorice root) *chai/doodh* - Take 150 mL water/cow's milk and boil it. While water/cow's milk is boiling add 3-5 gms fine powder of *Muleti* to it and allow the same to boil for one minute and then cover the vessel with a lid. After that stop the flame. Allow it for cooling for 1-2 min then sieve it and drink. This has to be continued throughout this Corona season. Daily you may consume in the morning and evening as per the comfort³⁸. This can be used at all the levels of care.
7. *Haridrakhanda*³⁹– Haldi (turmeric) is the major ingredient in this formulation. It is available in the granules form. It can be consumed with lukewarm water or warm milk on empty stomach. This can be used at all the levels of care.
8. *Samshamani vati*⁴⁰ (*Giloyghan vati*) – highly praised recipe for it's immunomodulatory effects^{41,42}. It maintains the homeostasis of the doshas⁴³. This drug has been mentioned in the advisory issued by Ministry of AYUSH⁴⁴, Govt of India as preventive and prophylactic remedy.
9. *Saraswatarishta* with Gold⁴⁵ - Its therapeutic benefits are // *balakanam cha younam cha vriddhanam cha sada hitha // naranari hitho nityam paramojaskaro matah //* For all age groups of children, youth and old age persons and for both sexes it is beneficial all the times and can be taken regularly⁴⁶. It is best immune booster. // *amrita samah //* It is equivalent to ambrosia or nectar. // *akalamrityu haranam //* - It Prevents untimely death and // *rasayana varah //* - Best immunomodulator. It is reported to have best free radical scavenging potentials⁴⁷. And also studies proved its antidepressant effects⁴⁸ which is essential in the quarantine (self and special) cases and PTSD of COVID-19 cases. It can be used at the different levels of care.
10. *Swarna bhasma* – Gold quickly destroys all poisons even *gara visha*. Just as water fallen on lotus leaves cannot wet it, *visha* cannot destroy a person who is administered with *swarna bhasma*⁴⁹. Researchers also established that Gold perpetuates “stemness”⁵⁰ and non-specific immunity⁵¹.
11. *Kanakasavam*⁵²⁻⁵³ - Highly beneficial in all types of *Swasa and Kasa, Yakshma, kshatakshinam, jirna jwara, raktapitta and urakshatam*. Major ingredient in this formulation is *Draksha* which is considered as ‘*phalottama*’ (best fruit) (AH). Pharmacological effects are ‘*brimhani*’ (nutritive), *kanthya* (soothing effect on throat), *virechanopaga*, *kasahara* (relives cough), *shramahara* (relives fatigue) and also beneficial in *swarabeda* (throat disorder), *dourbalya* (fatigue), *raktapitta* (bleeding disorder), *netraroga*, (eye disorder) *rajayakshma* (tuberculosis), *daha* (burning sensation), *trshna* (thirst), *jwara* (fever), *vamana* (vomiting), *shukra dourbalya* (semendisorders). The main ingredient is “*Dhatūra*” whose pharmacological effects are balances *vata* and *kapha*, *krimi* (antimicrobial), *vishapaha* (antipoisonous). It can be used in recovered cases and also as add-on therapy in the COVID management.
12. Tablet *Fifatrol* – It is an ayurvedic herbomineral proprietary drug. The composition of the formulation⁵⁴ is aqueous dried extracts of *Giloy* 600 mg, *Daruhaldi* 300 mg, *Apamarga* 200 mg, *Chirayata* 200 mg, *Karanjbeej* 200 mg, *Katuki* 100 mg, *Tulasi* 100 mg, *Musta* 50 mg, and powders of

Godanti bhasma 100 mg, Tribhuvankirti ras 60 mg, Mrityunjaya ras 60 mg, Sudarshanghan vati 60 mg, Sanjivani vati 60 mg, Processed in decoctions of Tulsi, Giloy and Apamarga. Researchers from AIIMS Bhopal have reported that Fifatrol can be a good substitute to allopathic antibiotics to treat infections, and that too without causing any side effects. But the Fifatrol drug has not only been found to enhance immunity but also found suitable in controlling spread of infectious diseases⁵⁵. This drug can be used as monotherapy along with other ayurvedic drugs and/or add-on therapy in COVID management and also a drug of choice in recovered cases for symptom management.

13. *Mritasanjivani arishtam*⁵⁶ - Polyherbal hydro-alcoholic formulation prepared by fermentation and distillation process. Therapeutic benefits are *deha dardyakara* (improves tonicity of the body), *pushtikara* (improves nourishment), *balakara* (promotes strength and immunity), *agnivardhana* (promotes digestion), *sannipata* (useful in life threatening conditions), *ghora jwara* (life threatening fevers), *shete dehe* (last resort to give life to a person). This drug can be used as monotherapy along with other ayurvedic drugs and/or add-on therapy in COVID management. This has to administer in frequent doses (*muhurmhur*).
14. *Shishubharan ras*⁵⁷ - It is an ayurvedic herbomineral proprietary drug. The composition of the formulation is Kumarakalyana ras 10 mg, Sitopaladi churna 150 mg, Sanshamani vati 20 mg, Madhumalini vasant ras 20 mg processed in Draksha. This combinations seems to more ideal targeting all the clinical areas of this COVID-19. This drug can be used as monotherapy along with other ayurvedic drugs and/or add-on therapy in COVID management. This drug can also be used in recovery cases as per the need.
15. *Kas shwas hari ras*⁵⁸ - It is an ayurvedic herbomineral proprietary drug. The composition of the formulation is Shwaskas chintamani ras 10 mg, Nardiya lakshmilvilas ras 50 mg, Sootasekhara ras 50 mg, Talisadi churna 120 mg processed in Vasa. This combinations seems to more ideal targeting all the clinical areas of this COVID-19. This drug can be used as monotherapy along with other ayurvedic drugs and/or add-on therapy in COVID management. This drug can also be used in recovery cases as per the need.
16. Classical ayurvedic formulations such as Sameerpannag ras, Gorochanadi gulika, Brihat Kasturibhairav ras, Swasanandam gulika, Vayu gulika, Vettumaran gulika, Sheetamshu ras etc are the drug of choice as per the severity of the symptoms.
17. Proprietary formulations such as Swasakalp syrup, Swaskalp tablet, Shwasamritam granules etc are also beneficial based on the ingredients of the formulations. They can also be used at different levels of care as per the need and availability.
18. *Trivrit lehyam*⁵⁹ - as it is known fact that the virus remains in the body even after the clinical and biochemical recovery from COVID-19. Considering the principle of “*jwara mukte virechanam*” it is ideal to advise Trivrit lehyam (trivrit possesses vishaghna property) to remove the viral antigens from the body. So it is advisable in recovered cases and also cases with residual issues.
19. *Agastya rasayanam* - Classical ayurvedic herbal formulation. Benefits are *Ayubala vardhanam* (enhances lifespan, strength), *sreshtha rasayana* (best immunostimulant) and indications are *panchavidha kasa, hikka, kshaya, vishama jwara, pinasa, aruchi, hridroga etc.* This drug can be used in recovery cases to enhance the immunity and to relieve the lingering symptoms. This drug has been mentioned in the advisory issued by Ministry of AYUSH⁶⁰, Govt of India for symptom management and add-on therapy.
20. The *jwara* caused by *shapa* (curse), *abhichara* (tantric rituals with evil purpose), *bhutabhishanga* (affliction by micro organisms or evil spirits), *daiva vyapashraya chikitsa* (performance of spiritual therapies) is the most desired therapy (Ch.Chi.3/317).
21. Ayurveda strongly emphasizes on diet and lifestyle modification in the management of the diseases, which is also applicable to this condition.

Scientific rationale of some Ayurvedic drugs & measures -

A. Yashtimadhu - *Glycyrrhiza glabra* (liquorice) root
Pharmacological effects of *Yashtimadhu* are *Jivaniya* (vivifying - To give or bring life to), *Angamarda prashamana* (pacifies fatigue), *shonithasthapana* (styptic), *Dahaprashamana* (pacifies burning sensation in Jwara), *Kantya* (soothes oropharynx), *Rasayana* (Immunomodulator), *Tridoshahara* (pacifies all three dosha). Studies also proves that *Yashtimadhu* have specific effects against SARS-CoV⁶¹⁻⁶³.

Almost 3500 research articles of *Glycyrrhiza glabra* are available on Pubmed⁶⁴. Major active

constituent of *Yashtimadhu* is Glycyrrhizin. Glycyrrhizin is a saponin-like compound that gives the fundamental sweet flavor for licorice, with potential immunomodulating, anti-inflammatory, hepato- and neuro-defensive, and antineoplastic effects. Glycyrrhizin regulates certain enzymes involved in inflammation and oxidative stress, and downregulates certain pro-inflammatory mediators, thereby shielding against inflammation- and reactive oxygen species (ROS)-induced damage⁶⁵.

Glycyrrhizin is considered under Broad-spectrum antiviral agent⁶⁶ (BSAA). The BSAA's hinder viral or host factors and block viral replication, diminish the viral burden to a level at which host immune responses can manage it or encourage apoptosis of infected cells⁶⁷. BSAA's could be combined with other antiviral agents or combinations of 2–3 BSAA's to obtain synergistic or additive effects against certain viruses or to target an even broader range of viruses. Such combinations could serve as front line therapeutics against poorly characterized emerging viruses or re-emerging drug-resistant viral strains^{68,69}.

Glycyrrhizin is found to inhibit the wide range of viruses⁷⁰ such as Hepatitis C virus (HCV), Enterovirus A (HEV-A), Enterovirus B (HEV-B), SARS-CoV, Influenza A virus (FLUAV), Human Parainfluenza Virus 2 (HPIV2), Epstein-Barr virus (EBV), Herpes simplex virus 1 (HSV-1), Kaposi Sarcoma associated Herpes virus (KSHV), Rubella virus (RV) and HIV-1 in cell culture studies.

B. Guduchi (*Tinospora cordifolia* (Willd.) Miers ex Hook and Thomas)

The sanskrit term for *Tinospora cordifolia* is *guduchi* which means 'protects from diseases' and other synonym is 'amrita' which means 'like ambrosia or nectar makes immortal'. Pharmacological effects of Guduchi are *Tridoshahara* (pacifies tridosh), *rasayana* (immunomodulator), *Balya* (gives strength), *agnidipani* (promotes digestion), *Kasahar* (relieves cough), *vishagni* (antipoisonous), *jwarabhutaghni* (Anti-viral fever), *Vayahsthapana* (stabilizes ageing), *chakshushya* (promotes vision)⁷¹ etc.

Almost 400 research articles on *Tinospora cordifolia* are available on Pubmed⁷². *Tinospora* contains almost 50 diverse phytochemicals including alkaloids, phytosterols, glycosides, lignans, terpenoids and mixed other chemical compounds⁷³. Most of these active compounds are known for immunomodulatory (α -Dglucan, G1-4A, N-formylannonain etc), anticancer (berberine, palmatine,

clerodane furano diterpene etc) and rest as antioxidants, all these compounds are effective against oxidative, inflammatory and cancerous disease directly or indirectly through series of chemical processes⁷⁴. *Tinospora cordifolia* can be used as a source of berberine and possible anti-inflammatory activity of *Tinospora cordifolia* may be attributed to the presence of berberine⁷⁵.

Berberine is an organic heteropentacyclic compound, an alkaloid antibiotic, a botanical anti-fungal agent isolated from many kinds of medicinal plants⁷⁶. It interacts directly with nucleic acids and with several proteins, including telomerase, DNA topoisomerase I, p53, NF- κ B, MMPs and estrogen receptors. Preliminary clinical proof endorse the capacity of berberine to reduce endothelial inflammation enhancing vascular wellbeing, even in sufferers already stricken by cardiovascular diseases⁷⁸.

Results of a study demonstrated that berberine emphatically stifled viral replication in A549 cells and in mouse lungs. It additionally eased respiratory inflammation and decreased necrosis, incendiary cell penetration, and pneumonic edema actuated by viral contamination in mice in comparison with vehicle-treated mice. Berberine smothered the viral contamination initiated up-regulation of TLR7 signaling pathway, such as TLR7, MyD88 and NF- κ B (p65), at both the mRNA and protein levels. Besides, berberine fundamentally hindered the viral contamination initiated increment in Th1/Th2 and Th17/Treg proportions as well as the pro-inflammatory cytokines production⁷⁹. Berberine is also considered under Broad-spectrum antiviral agents⁸⁰. Berberine is found to inhibit the wide range of viruses⁷⁰ such as Chikungunya virus (CHIKV), Hepatitis C virus (HCV), Enterovirus A (HEV-A), Enterovirus B (HEV-B), Sindbis virus (SINV), Zika virus (ZIKV), Influenza A virus (FLUAV), Respiratory syncytial virus (RSV), Cytomegalic virus (CMV), Human papilloma virus (HPV), Herpes simplex virus 1 (HSV-1) and HIV-1 in cell culture studies.

C. Haridra (*Curcuma longa*)

The sanskrit term haridra means 'liked by lord Hari' and also means 'which improves skin complexion and cleanses skin'. Pharmacological properties are *Krimighni* (antimicrobial), *vishaghna* (antipoisonous/viral), *sleshmashamana* (pacifies kapha), *vishodhini* (natural detoxifier), *Pinasanashini* (relieves rhinorrhea)⁸¹ etc.

Almost 15000 research articles of *Curcuma longa* are available on Pubmed⁸². Curcumin is a characteristic

component of the rhizome of haridra. Curcumin hinders the formation of reactive-oxygen species, has mitigating properties because of restraint of cyclooxygenases (COX) and different chemicals associated with inflammation and upsets cell signal transduction by different mechanisms including hindrance of protein kinase C⁸³. Curcumin also shows protective effects on Lung Inflammatory and Structural cells as in Fig. 2^(ref.84) which is much needed in the management of COVID-19 cases.

D. Kalmegha or Bhunimba (*Andrographis paniculata*)

Pharmacological properties of Bhunimba are *Katu vipaka, sheeta virya, laghu ruksha guna, tikta ras, kaphapitta har, dipana, jwaraghna, krimighna, rechana, pittasaraka* etc. The main active constituent of Bhunimba is Andrographolide⁸⁵. Andrographolide could be a labdane diterpenoid incorporates wide extend of restorative applications counting anti-inflammatory, anti-platelet conglomeration exercises and potential antineoplastic properties. The proposed mechanisms of broad spectrum effects of this phytomolecule are –the mitigating effects of this agent have all the earmarks of being identified with the restraint of nitric oxide (NO) creation by macrophages. This agent may initiate the NO/cyclic GMP pathway and repress both the phospholipase C gamma 2 (PLC gamma2)/protein kinase C (PKC) and PI3K/AKT-MAPK flagging pathways in enacted platelets to hinder platelet

collection. In initiated platelets, these three flagging pathways are downstream of integrin enactment interceded by collagen binding and impact the relationship of fibrinogen with its receptors. Moreover, andrographolide may apply its enemy of disease movement through the enlistment of cell cycle capture at G0/G1 stage and the incitement of lymphocyte expansion and initiation. These cycles could bring about diminished multiplication of and expanded immunocytotoxicity against tumor cells⁸⁶.

An *in silico* study on Andrographolide as a potential inhibitor of SARS-CoV-2 main protease found that Andrographolide was docked effectively within the binding site of SARS-CoV-2 Mpro. Computational approaches moreover predicts that this molecule to have great dissolvability, pharmacodynamics property and target precision. This molecule too complies Lipinski's rule, which makes it a promising compound to seek after advance in biochemical and cell based tests to investigate its potential for use against COVID-19⁸⁷.

Different studies also reported antiviral activities of Andrographolide against HBV⁸⁸, HIV-1^{89,90}, HSV-1⁹¹⁻⁹³, Influenza virus⁹⁴, Epstein Barr virus⁹⁵, CHIKV⁹⁶; immunomodulatory effects⁹⁷⁻⁹⁹ and its specific effects on upper respiratory tract and lungs¹⁰⁰⁻¹⁰⁵. The formulation having Bhunimba as an essential ingredient reported to have antiviral properties¹⁰⁶⁻¹⁰⁷.

E. Punarnava (*Boerhaavia diffusa*)

Pharmacological properties are *vatakapaha hara* (mitigates vata and kapha dosha), *Kasahara* (relieves cough), *vayah sthapana* (stabilizes ageing), *hridroga* (heart disease), *Swasa* (relieves breathlessness), *shotha* (relieves edema), *pandu* (relieves anemia), *kaphapaha* (relieves sputum), *garavisha* (relives toxic conditions) etc.

A systematic review and meta-analysis study found that "use of ACE inhibitors was related with a significant reduction in chance of pneumonia by 34% when compared with controls." Besides, "the chance of pneumonia was too diminished in patients treated with ACE inhibitors who were at higher risk of pneumonia, in specific those with stroke and heart failure¹⁰⁸." Coincidentally *Punarnava* was reported to have ACE inhibitory activity¹⁰⁹⁻¹¹¹.

F. Dhatura (*Datura metel*)

Sanskrit term dhatura means 'it squeezes sleshmadi dhatu'. Its synonym is 'shivapriya' means liked by Lord shiva. Ayurveda considers COVID-19 as Jwara epidemic which is due to 'Rudrakopa' (aggression of

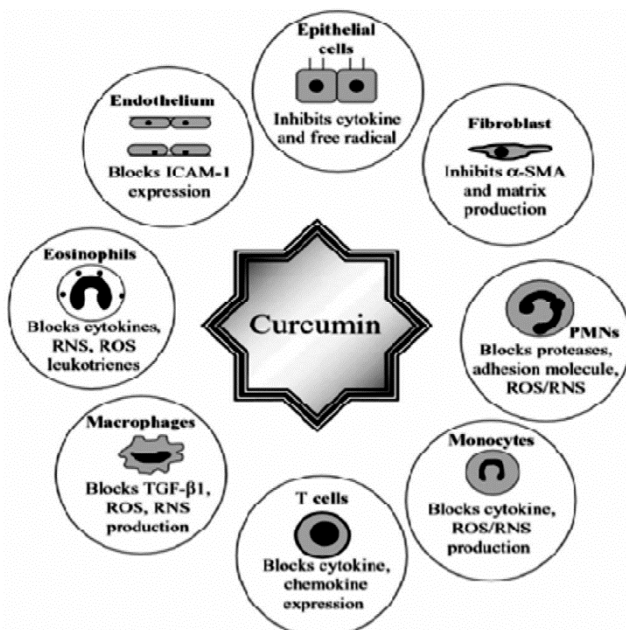


Fig. 2 — Protective effects Curcumin on Lung inflammatory and structural cells⁸⁴.

Lord Shiva). Pharmacological effects are balances vata and kapha, krimi (antimicrobial), vishapaha (antipoisonous) etc.

Coincidentally the spherical structure of corona virus with spikes simulates with thorn apple i.e., fruit of *Datura metel* as Delete in Fig. 3. This is also considered as basis for the selection of the drug as per Ayurveda, which may show its effects against corona virus by prabhava effect. So studies on this drug are also area of research.

G. *Lasuna* (*Allium sativum*) (*Lasuna*) also regarded to target the viral replication of SARS-CoV, springing up as promising candidates towards SARS-CoV-2¹¹².

From the above descriptions it is clear that, these are compelling evidences that medicinal herbs may be a first line of protection in opposition to infectious sicknesses. Indian medicinal plants are probably to be ability drugs for potential remedy of COVID-19. It may be recommended that conventional Indian medicinal plants as possible novel healing agents targeting on SARS-CoV-2 and its pathways. Hence, by means of repurposing the Indian medicinal plants, more revolutionary remedy options can be penned down for their role in defeating this viral transmission.

H. *Dhupana karma* – Ayurvedic fumigation therapy

Therapeutic aerosol delivery has been an essential methods of treating lung conditions. In ancient times, therapeutic aerosols were frequently delivered by smoking or setting home grown blends in a warmed compartment and breathing in the subsequent fumes¹¹³. Fumigation therapy is one of the treatment strategies portrayed in Ayurveda whereby exhaust delivered from characterized medicated formulations are breathed in by patients (*dhupana nasya*). Ayurveda suggests fumigation as a technique for cleansing and remedial methodology for different

human maladies including microbial diseases and mental issues¹¹⁴. Results of a study suggest that the combustion process in smoke inhalation therapy produces an ‘extract’ with superior antimicrobial activity¹¹⁵ and also a study reported from IIT Madras in 2016 on isolation, characterization, and application of the carbon nanomaterial from turmeric smudges demonstrated the antibacterial effect of turmeric smudges and validated the crucial role that the nano carbon play in the ethanopharmacological aspect of turmeric smudges¹¹⁶.

Aparajitha Dhooma choornam is mentioned in Ayurvedic texts in the context of *Jwara Chikitsa* for fumigation. The fumigation prevents the spread of infectious fever and also disinfects the air from pathogens. Study also establishes the antimicrobial activity of *Aparajitha Dhooma choornam*¹¹⁷.

I. The ‘behavioural immune system’ is composed of mechanisms that evolved as a means of facilitating behaviours that minimized infection risk and enhanced fitness¹¹⁸. Use of face masks, hand hygiene and respiratory etiquette are simple cost-effective behavioural interventions to prevent the infections in the community particularly in vulnerable populations. This in due course develops behavioural immune system.

Discussion

Always pandemics poses challenges to the science; which make us to think out-of-box so as to innovate and to generate evidence to prove the same and in turn to save lives. For Ayurveda, it is the right opportunity to generate data and valuable evidence on its use to beat COVID-19. In this context the words of Prime minister of India Narendra Modi holds relevant i.e., "world will surely accept our ages old Ayurvedic principles like yoga, provided the same has to be explained to the world in a scientific language, so that they understand it" reminds entire Indian scientific fraternity to work for our own strength and glorious tradition of Ayurveda¹¹⁹. In the name of ‘evidence’ researchers look at Ayurveda from the perspective of conventional drug discovery which is based on ‘one’ paradigm i.e. one molecule-one target-one effect-one disease approach which is quite opposite to the Ayurvedic principles i.e., multiple constituents-multi targets-synergistic effects-different diseases. Most of the Ayurvedic research on drugs is not on discovery rather it is ‘rediscovery’ in a sense of understanding the mechanism of drug efficacy. If we try to apply one paradigm approach to Ayurveda so as to generate evidence, all efforts will go in vain.

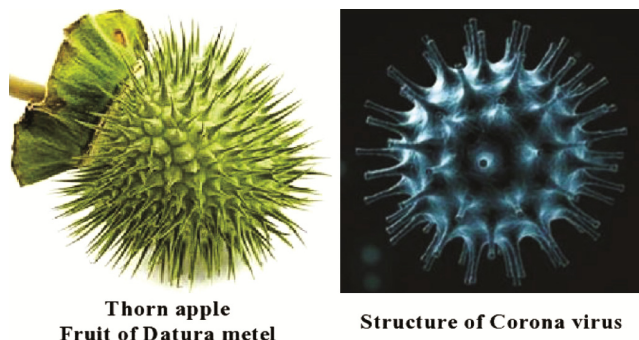


Fig. 3 — Morphological simulation of thorn apple and corona

The purpose of any science is to help the mankind. For the benefit of mankind, modern physicians and scientists may keep their ‘ego of science’ aside, think of our own knowledge system of healthcare – Ayurveda which is evolved and existed since centuries on this land; in the interest of public health in crucial times. Just on the reason of ‘lack of evidence’ one cannot keep Indians deprived of Ayurvedic drugs during this critical time.

Conclusion

WHO Director-General in a virtual media briefing of COVID-19 from Geneva on 13 April 2020 said that, “The way forward is solidarity: solidarity at the national level, and solidarity at the global level”¹²⁰. Our perception of solidarity is ‘solidarity among available healthcare systems in the interest of public health to find the cure for SARS-CoV2 is the need of the hour. If the traditional medicines are allowed for the use in the cases of COVID -19 as add-on therapy or monotherapy on the basis of their usage in the society since centuries in the similar symptomatology and also on the grounds of marijuana use by Pennsylvania¹²¹; definitely this combo of integrative medicine will become “biggest game changers in the history of medicine”.

Different levels of COVID care as discussed and detailed in the article are applied in true spirit, then Ayurveda can definitely create a huge impact in the containment of COVID-19. Ongoing uncertain situation of COVID -19 reminds us about the basic premise of the management i.e., Prevention is better than cure, because viral diseases are hard to cure and once contacted, they can be life-threatening. Considering the gravity of the situation, It is apt to say that Prevention is only and ultimate cure of COVID- 19. Prevention and protective measures for COVID-19 are given as an acronym **NAMASTE** - **N**o to Handshake, **A**void social interactions, rumours and stigmatization, **M**ask wearing, **A**ware about COVID & Adopt ayurveda Immunity measures for self-care, **S**ocial distancing & self-hygiene, **T**esting and tracing & **E**tiquette (hand & respiratory).

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Conflicts of Interest

Authors declare that there are no conflicts of interest.

Author Contributions

Both the authors contributed equally in all aspects.

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