



Role of Indian traditional medicine in mitigating novel corona virus effects

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Novel Coronavirus (2019-nCoV) with a distinct feature of transmitting debilitating infection from person to person, originated in Wuhan, a small town in China, was identified during December 2019. It has spread very fast and affected number of people in China and other countries in a very short period of time. When the whole world is trying to combat COVID-19, the respiratory disease caused by novel Corona virus, there is an urgent need to explore the efficacy of alternate medicine as preventive measure. Traditional medicine which boosts the immune system may be one of the best and immediate answers to this global health crisis. The WHO declared: “there is no specific medicine till date proposed to prevent or treat the novel Coronavirus”. But several studies confirmed that, through medicinal plant extracts inhibition of viral replication is possible. Myriad herbal remedies, of which some scientifically supported, are used to treat cold and flu symptoms. Herbs such as tulsi, giloy, lemon balm, mint, methi and also amla, ginger, turmeric are helpful in strengthening the immune system which is the key to fight the deadly virus. Several oils and selected fruits also increase the efficiency of immune system thus protecting the body against viral infections especially against respiratory illnesses.

Keywords: Corona virus, COVID 19, Herbal remedies, Immune system, Traditional medicine

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Infections that occur in the lungs, chest, sinuses, nose and throat are called respiratory infections. Most microorganisms causing respiratory infections can be passed from one person to another. Coughing, sneezing, breathing, respiratory droplets etc. from a person, can infect healthy person. After being in contact with person who has respiratory infection or by touching objects exposed to the virus may transmit the virus if we touch eyes, nose or mouth¹. According to their symptomatology, the respiratory tract infections are grouped as Acute Upper Respiratory Infections (URI) which includes infections like common cold, laryngotracheitis, pharyngitis, and epiglottitis. These infections, can be lethal to children and young infants, especially epiglottitis and laryngotracheitis though usually are transitory and self-limited². Causative agents of URI include Bacteria, Mycoplasma, Fungi and Viruses. Transmission of respiratory infections commonly starts in the winter, when schools reopen and due to overcrowding. For various human pathologies including cancer, viruses are responsible. Though viruses cause most colds, most common pathogens

are Rhinoviruses with about 100 serotypes responsible for 25% of colds in adults³. More than 10% of cases are caused by Coronaviruses. Other viruses linked with common cold symptoms are influenza viruses, parainfluenza viruses, respiratory syncytial viruses and adenoviruses which exhibit seasonal variations in their occurrence and causing infections⁴. Lack of specific and immediate vaccine/antiviral therapy to COVID 19, here we make an attempt to provide insight of the benefits of Indian traditional medicines in strengthening the immune system.

Corona viruses

Corona viruses are responsible for various diseases ranging from URI in chickens to human respiratory infections which can be lethal. CoVs belong to Nidovirales, order: Coronaviridae, family: Coronavirinae⁵. This family is further divided into α , β , δ and γ Coronaviruses. CoVs are enveloped within diameter of 125 nm. The club shaped spikes projected from the surface of virion give the name corona, as they resemble the solar corona. Nucleocapsid within the envelope is helically symmetrical and contains 30 kb RNA which is non-

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segmented and of positive sense (Fig. 1). They adhere to host cells through their envelope spike proteins and enter so that they replicate and will be released^{6,7}.

COVID 19- Current pandemic

The emergence of various, new Coronaviruses that cause diseases in human and animals prevailed over the past 50 years. Bat-SL-CoVZC45 and bat-SL-CoVZXC21, obtained in 2018 at Zhoushan of Eastern China showed similarity with 2019-nCoV causing COVID 19^(ref.8). These viruses will continuously emerge, evolve and cause both human and veterinary outbreaks, due to their capacity to infect multiple species and cell types and to recombine and mutate. Since novel bat CoVs are the likely ultimate source for SARS-CoV and MERS-CoV (Middle East respiratory syndrome) intense interest is shown in identifying them. Over the past decade, scientists identified great many number of new bat Coronaviruses⁹. Plethora of promising anti-viral targets, viz, viral entry proteins, proteases and polymerases have been identified through research which is stimulated due to the outbreaks of SARS and MERS¹⁰.

Respiratory diseases and alternate therapy

The 2015 outbreak of viral disease MERS-CoV in South Korea reported 38 deaths, though in the Middle East, it occurred as always endemic. *Coronaviridae* family of single-stranded, positive-sense RNA viruses which are enveloped includes MERS-CoV¹¹. In Korea, 502 compounds obtained from plant sources were screened and tested to detect their capacity to block MERS-CoV entry into cells. Dihydroshansinone, a potent lipophilic compound isolated from *Salvia miltiorrhiza* Bunge roots, commonly used in traditional Asian medicine, can be a good candidate to block entry of MERS-CoV into the host cells¹².

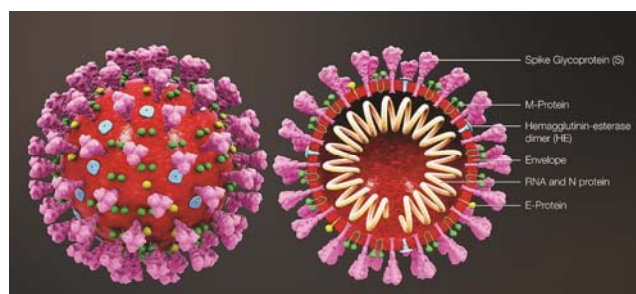


Fig. 1 — Structure of Corona virus¹⁰

The first preliminary work on TCM (Traditional Chinese medicine) treatment depending on differentiation of syndrome was performed in the treatment of Idiopathic pulmonary fibrosis (IPF), a chronic, progressive and ultimately fatal interstitial lung disease with unknown etiology. They did a basic evaluation of the efficiency and safety of TCM treatment, which exhibited improved respiratory function and exercise capacity¹³.

A study has shown that Emodin isolated from plants from family Polygonaceae is efficient in blocking the interaction of the SARS-CoV SNE (spike and envelope gene)-encode protein an ion channel protein 3a (virus release is helped in the infected cells, through an ion-permeable channel by a 3a protein coded by SARS-CoV open reading frame ORF-3a). Emodin or its derivative compounds may become efficient novel therapeutic agents in the control of Coronavirus-induced diseases and also SARS as reported¹⁴.

Chinese herbal medicines have been reported to contain numerous absorbable components which exert their effects on the body. From the Chinese medicine database, 125 herbs were selected containing 13 natural compounds. Out of the 125 plants, only 26 herbs, included detoxifying, antipyretic, antitussive, antiasthmatic and also phlegm resolving medicines that were found to be regularly used in the treatment of respiratory infections caused by viruses and exhibited antiviral/immune modulatory/anti-inflammatory activity¹⁵.

Yang Yang *et al.*¹⁶, in their review, discussed about various drugs and preventive measures for the COVID -19 infection. In the therapy of SARS-CoV-2 infected persons, drugs like HIV protease inhibitors viz., ritonavir and lopinavir were employed but in combination with suitable antibiotics or with IFN α -2b were listed. Nucleoside analogs such as ribavirin used rigorously during the outbreaks of SARS and MERS, may also be effective in COVID-19 therapy. Nucleoside analogs favipiravir (T-705) was potentially used to block the activity of RNA polymerase of influenza viruses and its anti-SARS-CoV-2 activity is reported by a recent *in vitro* study. Remdesivir showed potent *in vitro* and *in vivo* antiviral activity against several RNA containing viruses including SARS and MERS which also can be most effective antiviral drug for COVID-19 therapy. They also emphasized the use of drugs such as Chloroquine, and pharmaceuticals like corticosteroids, interferons and even convalescent

plasma for treatment. TCM is looked upon as an alternate medication for COVID-19 patients as it was reported that TCM treatment has benefitted patients with SARS-CoV infection.

Lau and colleagues¹⁷ in their report announced that, during the outbreak of SARS, TCM herbal extract, namely *Sang Ju Yin* plus *Yu Ping Feng San* were used by 1063 volunteers of which, 926 were hospital workers and 37 high risk laboratory technicians. None of TCM users were infected when compared with the control group with only 0.4% of infection. T cells modulation to enhance host defense capacity was also exhibited by *Sang Ju Yin* plus *Yu Ping Feng San*. The additional treatment with TCM resulted in reduction in symptoms and decreased the course of the disease as reported by a controlled clinical study.

Dr Faheem Younus, chief, University of Maryland, UCH, on NDTV Exclusive said that plasma from Corona recovered patients can be good but it is protective yet not proven as treatment.

Role of the Indian traditional medicines

Lack of preventive vaccines and antiviral therapies pose a potential threat to public health, with the enhanced global travel and rigorous urbanization, epidemic outbreaks in alarmed rate is seen, due to the existence of emerging and re-emerging viruses¹⁸. Only feeble numbers of antiviral drugs are approved for clinical practice and large numbers of viruses still remain without efficient immunization till date. There are several US and Chinese patents filed for various herbal compositions to treat viral infections. Herbal antiviral components, which have easy access and do not require prolonged pharmaceutical synthesis, are exploited as important alternatives to the growing drug resistance to antiviral therapy. Figure 2 highlights the importance of traditional medicine during viral outbreaks¹⁹.

For different illnesses, including viral infections, herbs have been exploited since ancient times as natural remedies. Traditional medicines (TMs) make use of many herbs and their products with effective results as recorded by fossil records dated back to 60000 years. Various forms of traditional medicine are Ayurveda, Siddha, Unani etc, which employ many natural products are being practiced for thousands of years globally. In India Ayurveda dates back to the pre-Vedic epochs (4000 BC–1500 BC)²⁰. Though there are positive results observed by administering herbal drugs, major constraints are unavailability of an allopathic drug and lack of knowledge of the viral



Fig. 2 — Need for an alternate therapy to manage COVID 19

strain responsible for causing infection. Under the leadership of Dr MS Valiathan, a project was undertaken with the support from office of the Principal Scientific Adviser to the Government of India and the Department of Science and Technology. Main objective of this project was to study the Ayurvedic concepts, treatment procedures and mechanistic basis of therapeutic effects and apply scientific methods²¹. Many medicinal herbs have been found to work effectively for certain infections. Some medicinal herbs work when combined with modern medicine and life support system under proper observation for several viral diseases. Identification of the antiviral products from herbs provides a rich resource for novel drug development especially antiviral drugs. This has shed light on their ability to interfere with the entire viral life cycle, including viral entry, replication, assembly and release, and also to target specific virus–host interactions²².

Herbs to strengthen immunity

There is a report that elderberry (*Sambucus nigra*) enhances the production of specific immune cells and also block spreading of flu virus²³. Experiments proved that concentrated juice of elderberry exhibited strong antiviral activity against influenza virus infected mice and increased IFV virus specific antibodies in serum. Study reported black elderberry extract as 68% effective against swine flu (H1N1)²⁴.

Sage (*Salvia officinales*) is an aromatic herb employed in traditional medicine in the cure of viral infections, and has saffinoline which is found in the stem and leaves of the plant. Study reported that, of

the various Sage species and their extracts studied, chloroform extract was found to inhibit HSV1 and PI3 effectively²⁵.

Astragalus (*Astragalus propinquus*) is a small herb most popularly used in Chinese traditional medicine which has potent immune-boosting and antiviral qualities and controls hepatitis C virus, herpes viruses, and also avian influenza H9 virus^{26,27}.

Oregano (*Origanum vulgare*) is a small but important herb of the mint family, which includes carvacrol that offers antiviral properties. As a potent antibiotic and antiviral herb, its oil works well against respiratory illnesses^{28,29}.

Ginseng (*Panax ginseng*) known as Ashwagandha in Indian medicine is effective at fighting viruses. Compounds present in this plant with antiviral effects are called ginsenosides that work against viruses like Hepatitis B, Norovirus and Coxsackie viruses^{30,31}.

Tulsi (*Ocimum sanctum*) also known as Holy basil, is a natural immune booster, which helps to fight against viral infections. It normalizes blood glucose and blood pressure, also lipid levels and combats metabolic stress. It has anxiolytic and anti-depressant properties thus have positive effects on memory, cognitive function as well reduces psychological stress. Tulsi has antibacterial activity and can be used as a hand sanitizer, mouthwash and water purifier. It is known for its broad-spectrum antimicrobial activity, which includes activity against a plethora of human and animal pathogens. It is also employed in health tonics, animal rearing to prevent infections, wound healing to enhance immunity, also in the preservation of food stuffs and herbal raw materials^{32,33}. Tulasi's crude extract as well terpenoid obtained from the leaves of *O. sanctum* exhibited significant virucidal activity against H9N2 virus as reported using *in ovo* models³⁴.

Fennel (*Foeniculum vulgare*) is a licorice-flavored plant that may boost immune system, decrease inflammation and also may fight certain viruses. Herpes viruses, influenza and Parainfluenza Type-3 (PI-3), which causes respiratory diseases in cows were inhibited using fennel extracts³⁵.

Lemon balm (*Melissa officinalis*) extract has potent essential oils in it and has characteristic lemon taste and aroma. Plant compounds do possess antioxidant, anti-inflammatory and also antiviral activity against avian influenza (bird flu)^{36,37}.

Peppermint (*Mentha piperita*) is known to have strong antiviral activity. Antiviral and anti-

inflammatory activity has been detected in leaves of *Mentha piperita* as its essential oils contain active ingredients, including menthol and rosmarinic acid³⁸.

Echinacea purpurea, is used to fight viral infections particularly herpes and influenza, it also exhibited immune-boosting effects³⁹.

Rosemary (*Salvia rosmarinus*) has therapeutic applications more importantly against viruses due to its enormous plant compounds, especially oleanolic acid and acts against influenza, Herpes viruses, HIV and hepatitis as reported in animal studies^{40,41}.

Licorice (*Glycyrrhiza glabra*) has been long used in Chinese traditional medicine and has glycyrrhizin and liquiritigenin with powerful antiviral properties against viruses like herpes viruses, HIV, RSV, and also against SARS-related Coronavirus⁴².

Dandelion (*Taraxacum officinale*) has impressive antiviral effects against influenza virus. Moreover, one study showed that dandelion extract is used in treatment of mosquito-borne virus that causes dengue fever as it inhibited the replication of dengue virus⁴³.

Garlic (*Allium sativum*) possesses allicin and sulphur-containing compounds thus used for centuries as an immune enhancer and natural therapeutic agent for various respiratory infections. Animal and cell culture studies indicate that garlic may safeguard against viral infections as it boosts immune system response by invigorating protective cells of the immune system^{44,45}.

Turmeric (*Curcuma longa*), or curcumin, is being propagated since centuries for reducing lung inflammation which is highlighted now amid the rising COVID-19 cases in India. There are simple methods to use turmeric and to boost immune system during COVID-19 which may help reduce the severity of the infection. As bad cytokines/hormones, especially IL-6 and TNF rise which may be responsible for stress and organ failure during COVID-19 infection, turmeric/curcumin, resveratrol and lutein are effective molecules for lowering IL-6 naturally⁴⁶.

Ginger (*Zingiber officinale*) products have potential antiviral activity against viruses like RSV, feline calicivirus (FCV) and avian influenza. Products with ginger such as tonics, elixirs, green teas and dried lozenges, are advocated natural remedies. Additionally inhibition of viral replication and prevention of virus entry into host cells were exhibited by specific components in ginger, like gingerols and zingerone^{47,48}.

Other plants with antiviral activities are giloy (*Tinospora cordifolia*), kalonji (*Nigella sativa*), spices such as cinnamon (*Cinnamomum zeylanicum*), cardamom (*Elettaria cadamomum*), kalmegh (*Andrographis paniculata*), African geranium (*Pelargonium sidoides*), Asian red ginseng (*Panax ginseng*), American ginseng (*Panax quinquefolius*) and green tea (*Camellia sinensis*) which can prevent viral respiratory infections (VRI). Most of the medicinal herbs have built-in immune-modulating and inflammation-invigorating effects and also assist the immune system to combat better with the infections. They can aid in preventing immune overreaction (cytokine storm) to VRI^{49,50}.

In an investigation, it was identified that people from Pakistan detected 384 therapeutic plants, of 85 families for respiratory infections. Results showed that, many plants and herbs of Asteraceae family showed good antiviral activity and their leaves have been extensively used in the form of decoction to treat respiratory infections. It is essential to increase access to traditional medicine and to create awareness in rural areas. They emphatically supported traditional herbal medicine to be used sustainably by giving special attention to threatened species⁵¹.

Harri (2004) conducted studies at Finland and advocated Vitamin C as a powerful nutrient for enhancing immune capacity and preventing colds, because patients with respiratory infections who took vitamin C supplements were less likely to develop respiratory disorders like common cold and even Pneumonia⁵². A review on Coronaviruses emphasize on supportive treatment with various vitamins such as

vitamin A,B,C,D and E as they strengthen the immune system. Lacking vitamin B and D have been shown to decrease the efficiency of immune system and cause chronic illnesses, including respiratory illness⁵³.

Thyme (*Thymus vulgare*) is a small herb whose extract when employed *in vitro* on RC-37 cells in a plaque reduction assay, inhibited Herpes simplex virus HSV-1, HSV-2 and an acyclovir-resistant strain of HSV-1. These results indicated that though the extracts have no effect on the *in vivo* virus replication, they affect HSV before adsorption. Therefore, the extracts exhibit their antiviral activity on free HSV and are efficient in recurrent Herpes infections as topical therapeutic application agent⁵⁴⁻⁵⁷. Plants with antiviral activity are shown in Figures 3 and 4.

Natural products serve as good sources of antiviral drug molecules. Many natural ingredients and herbal products are shown to have potent antiviral activity and these discoveries also aid in developing various effective derivatives and therapeutic leads (e.g., novel anti-HBV agent -glycyrrhetic acid derivatives and influenza NA antagonist- caffeic acid derivatives). Chebulagic acid and punicalagin were discovered which inhibit entry of several viruses due to their GAG-competing properties; also provide leads to develop broad-spectrum antivirals for blocking entry and replication of various viruses⁵⁸.

Local folklore suggests several home remedies to prevent viral infections by strengthening immune system of our body. Hot water with lemon and honey, hot water with ginger, lemon and honey, hot milk with turmeric, honey and pepper, rosemary tea with ginger, onion extract with honey when consumed act

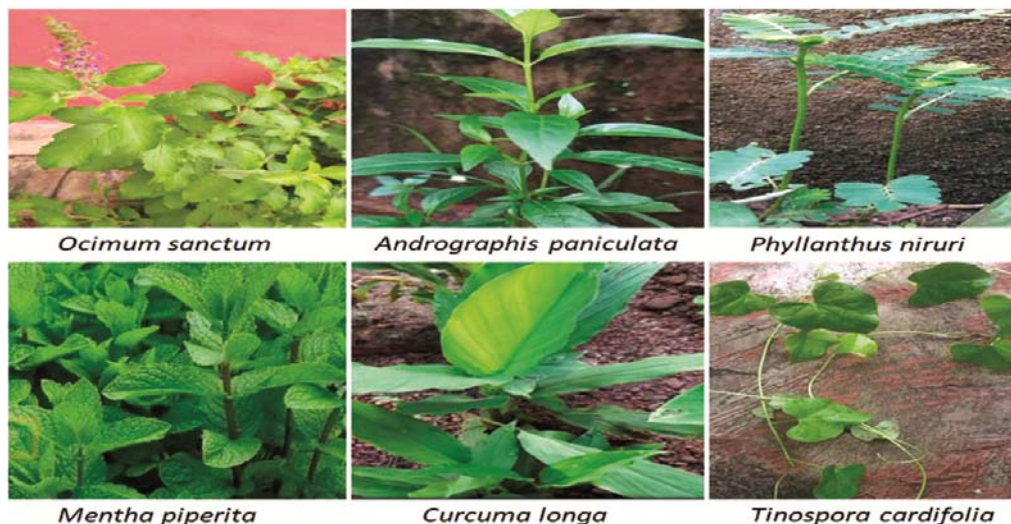


Fig. 3 — Medicinal herbs with antiviral activity



Fig. 4 — Aromatic herbs with antiviral activity used in traditional medicine

as anti-inflammatory concoctions and natural decongestants. They also dissolve mucus and relieve chest congestion^{59,60}.

Essential oils to combat flu viruses

Several antiviral essential oils such as *Eucalyptus globules*, *E. radiate*, cinnamon bark and clove bud⁶¹, lemon, *coleus*, lemon myrtle, saro, manuka, melissa, niaouli, ravensara, avintsara, *Phyllanthus*, tea tree, thymol⁶ and linalool are recommended for healthy adults which strengthen the immune system^{63,64}. Essential oils of Eucalyptus, Lavender, Rosemary, Thyme and Basil have anti-bacterial, anti-viral and anti-fungal activity. They are excellent for all respiratory problems and can be used in a diffuser or used for inhalation as anti-stress and anti-viral oil^{65,66}. Thyme essential oil has antimicrobial properties and thus, can be used on tissue to clean surroundings with it, like tables, furniture, cars, laptops and mobiles. Basil essential oil is very powerful anti-viral oil that helps to strengthen immune system. It can be also used by mixing 2-3 drops of basil oil with carrier oil for massaging on chest and stomach. All these oils work well and are without side effects^{67,68}.

A study on the efficacy of a natural product comprising of a synergistic blend of plant based oleoresins and essential oils in a liquid emulsion named as QR448 (a) against Avian infectious bronchitis virus in cell culture and animals was examined. It was shown to be virucidal on (IBV), a Coronavirus, that cause upper-respiratory tract disease

in chickens which is highly contagious. It is also shown to infect birds like peafowl (*Pavosp*) and teal (*Anas crecca*). It may also be effective against other respiratory viruses which are enveloped viz, avian influenza virus and Newcastle disease virus in poultry and other Coronaviruses in animals and humans⁶⁹.

Neutraceuticals to enhance immune capacity

Most important elements that maintain our immune system is a healthy balanced diet, which contains all the nutrients of proteins, carbohydrates, fats, vitamins and minerals in a balanced proportions with the adoption of healthy eating habits, such as adding more fresh fruits and vegetables in the diet. Various fruits and vegetables like strawberries, oranges, grapes, melons, broccoli, spinach, red bell peppers, sunflower seeds, mushrooms and chickpeas are known to have antioxidant properties and prevent infections by boosting immunity⁷⁰⁻⁷².

Conclusion

There are few scientific evidences that any of the above supplementary remedies can inhibit or cure the infection caused by Corona virus/related viruses. Thus it is clear from the above data that the large part of work that is taken up highlighting “Traditional Medicine (TM)” is related to plant pharmacology but as defined by the WHO, there is indeed very feeble work done related to “TM.” Because there is no effort to develop a drug that could prove useful for the various unmet medical needs that world faces

currently. In fact, one of the greatest advantages of TM's treatment is the "synergism" that is, often myriad ingredients in TMs play a synergistic role which is substantial than that of an individual drug. However, all TMs may boost immunity to enhance resistance. Myriad herbal remedies, some scientifically supported, are used to treat cold and flu symptoms. The best defense against the Coronavirus is being healthy when the infection hits, by having "a solid immune system" to minimize the chances of contracting COVID-19 and helping the body's defenses shut down the virus quickly once infected.

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Conflict of Interest

Authors declare no conflict of interest.

Author contributions

SR wrote the manuscript, KKG and KBS pooled up data, identification of medicinal plants mentioned and corrected of script.

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