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Therapeutic Potential And Antiviral Activity Of Medicinal Plants Against Sars-Cov- 2

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Abstract

Severe acquired respiratory syndrome coronavirus-2 (SARS-CoV-2), also known as COVID -19, is an extremely transmissible virus that has emerged as a pandemic. Currently, SARS CoV-2 is the most serious health issue which causing unexpected higher rate of death globally. To conflict this condition, people may benefit from the healing properties of medicinal plants, such as strengthening the immune system and creating antiviral effects. This study brings together traditional medicinal plants and their bioactive components to summarize and discuss techniques for combating viral diseases in general and strengthening the immune system in particular. The Crude extract or pure compounds isolated from medicinal plants and herbs have shown promising inhibitory effect against corona virus. Meanwhile, a number of alternative therapies are being explored for effective disease management. Various herbal medicines and essential oils have been reported to have antiviral activity, but this has not been well studied in the context of SARS-CoV-2. Researchers and medical organization are working to identify antiviral drug candidates. This review focused on the biology of the infection and various related therapeutic strategies, including drug repurposing and phytomedicines.

Keywords: SARS-CoV-2, antiviral drug, traditional medicinal plants, bioactive compounds.

INTRODUCTION

Viral infections are currently a global challenge for healthcare workers due to uncontrolled morbidity and mortality (Gholizadeh et al., 2020). The severity of coronavirus disease 2019 (COVID-19) is highly variable, with symptoms ranging from asymptomatic disease to severe acute respiratory infection. The recent COVID-19 pandemic caused by the SARS-CoV-2 virus has created unprecedented challenges for the world. Fever, dry cough, difficulty breathing, muscle pain, fatigue, loss of appetite, and loss of smell and taste are the most common symptoms. Coronaviruses are a large family of viruses that cause a wide variety of illnesses, from the common cold (some are seasonal coronaviruses) to more severe conditions such as SARS-CoV and Mers-CoV (Baharoon and Memish, 2019; Malik et al., 2020; Enayatkhani et al., 2020; Rice et al., 2022).

It is characterized by a decrease in immune system cells, including regulatory T cells, cytotoxic T cells, helper T cells, natural killer cells, monocytes/macrophages, and an increase in proinflammatory cytokines. With rapid acceptance, a rush for vaccines began and the scientific community came together to help develop effective treatments and vaccines. Natural products have been used as a source of individual molecules and extracts that can inhibit or neutralize several microorganisms, including viruses. When first tested during the SARS-CoV-1 outbreak in 2002, natural extracts showed effective results against the coronavirus family (Dhawan et al., 2023).

SARS-CoV2 infections first appeared in China in mid-December 2019, when outbreaks of pneumonia cases were reported in the seafood-consuming population and Chinese livestock markets (Chan et al., 2020; Li et al., 2020). . Finally, this epidemic was associated with a new =CoV related to SARS CoV based on similarity in genetic material (Lu et al., 2020). The disease was subsequently reported to be caused by SARS-CoV2 and named COVID-19 by the World Health Organization (WHO) (WHO, 2020a). As of 19 May 2020, approximately 4.73 million people worldwide have been infected with COVID-19 and 3.16 million have died (WHO, 2020b).
In addition, the virulence of synthetic antivirals and ineffective responses to resistant strains has fueled the search for effective and alternative therapeutic options such as plant-derived antiviral molecules. Consequently, most of the scientist reported the therapeutic effect of bioactive components of medicinal plants against the most virulent virus, namely SARS-CoV-2 (Bafandeh et al., 2023). Some essential bioactive compounds such as hesperidin, apigenin, luteolin, seselin, 6-gingerol, humulene epoxide, quercetin, kaempferol, curcumin, and epigallocatechin-3-gallate (EGCG) have been associated with SARS-CoV-2. It has been reported to inhibit several molecular targets and viral replication in many in silico studies. Therefore, antiviral medicinal plants and isolated bioactive compounds may be the subject of further advanced research aimed at developing effective and cost-effective antiviral drugs (Khaerunnisa et al., 2020).

THERAPEUTIC STRATEGIES BY PHYTOPHARMACEUTICALS

Traditional medicine has been around for decades, even before the advent of Western medicine. Various herbal compounds are known for their therapeutic effects. Medicinal plants are abundant in nature, but only a few plants have been scientifically evaluated for their therapeutic potential. Several herbal medicines are poorly regulated in many countries, mainly due to lack of efficacy and lack of uniformity of results. Therefore, their safety remains a major concern (Zhou et al., 2020; Zhou et al., 2021). However, many herbal medicines have exceptional therapeutic potential and low toxicity compared to synthetic drugs.
Phytochemicals are a limitless source for the development of potent pharmaceutical molecules and have been intensively studied in the current scenario against various diseases, especially the novel coronavirus disease (COVID-19) (Attia et al., 2020; Españo et al., 2021). Phytochemicals from Indian medicinal plants have been widely investigated for their ability to inhibit the targets of COVID-19 (Bachar et al., 2021). An herbal drug called diammonium glycyrrhizinate has anti-

inflammatory properties and has been administered to human subjects along with vitamin C and has been proposed as a treatment for COVID-19 in humans (Ding et al., 2020; Khanna et al., 2020).

Ayurvedic medicine, AYUSH 64, was first developed in 1980 by the Central Council of Ayurvedic Research (CCRAS) to treat malaria and is currently being used in Ayurvedic centers to treat COVID-19. It has been reused for human subjects. Additionally, arsenic albumin 30 is a herbal immune system booster recommended by AYUSH as a source for prevention of COVID-19 infection. *Kabasura kudinner* (ingredients Ginger, Piper longum, Clove, Dusparsha, Akarakarabha, Kokilaksha, Haritaki, Malabar nut, Ajwain, Kusta, Guduchi, Bharangi, Kalamegha, Raja pata, and Musta etc.) subject to the prevention and control of covid-19 (Vellingiri et al., 2020). *Andrographis paniculata, Cordia myxa, Cydonia alongong, and Zyziphus jujube* extracts showed more effectiveness as antioxidants, immune enhancers, and supporting antiviral activity in COVID-19 (Vellingiri et al., 2020; Murugan et al., 2021; Vincent et al., 2020). Currently, in the practice of traditional Chinese medicine (TCM), herbs such as Lianhua qingwen, *Scutellariae radix, Astragalus membranaceus, Lonicerae japonicae Flos, Fructus forsythia* are used in humans to treat COVID-19. These drugs also help to reduce cough, weakness, digestive disorders and anxiety caused by the disease (Runfeng et al., 2020). However, more research is needed in this area to open up a wide range of options for efficient treatment.

Ethnomedicine and herbal medicines have been widely used in many countries since ancient times. Organic herbal extracts and essential oils can treat conditions from common fevers to deadly viral illnesses with few side effects. Essential oils have great potential for disease management, mainly because they are rich in antibacterial properties. Many natural antiviral substances derived from Indian plants for SARS-CoV-2 remain unknown (Vimalanathan et al., 2009; ul Qamar et al., 2020).

Furthermore plants i.e. *Pergularia daemia (Forsskal), Chiov. (Asclepiadaceae), Gymnema sylvestre R. Br. (Asclepiadaceae), Sphaeranthus indicus L. (Asteraceae), Cassia alata L. (Caesalpiniaceae), Evolvulus alsinoides L. (Convolvulaceae), Clitori aternatea L. (Fabaceae), Indigofera tinctoria L. (Euphorbiaceae), Abutilon indicum G. Don. (Malvaceae), Vitextri folia L. (Verbenaceae), Clerodendrum inerme (L.) Gaertn (Verbenaceae), and Leucas aspera Spr. (Lamiaceae),* are abundant in India and show potential antiviral effects (Abdelli et al., 2021). Additionally, a list of Indian plants that exhibit antiviral properties against various viruses has been discussed in detail by Dhawan (2012). These compounds can be screened to evaluate their antiviral activity against SARS-CoV-2. Many of these compounds are currently being explored and computationally studied to inhibit SARS-CoV-2 (Dudani and Saraogi, 2021). Although many plant components have been discovered to target viral proteins, more *in vitro* and *in vivo* studies are needed to evaluate these in silico results and standardize treatment for COVID-19 (Table 1).

Table 1: Overview of the effects of medicinal plants extracts against SARS COV-2 .

Family	Species	Part used	Bioactive compound	References
Acanthaceae	*Andrographis paniculata*	aerial parts and roots	andrographolide	Intharuksa et al., (2022)
Acanthaceae	*Justicia adhatoda L.*	Leaf	Anisotine, Daucosterol	Ghosh et al,. (2021); Ramesh et al., (2022)
Amaryllidaceae	*Allium sativum L.*	Bulb	Alliin	Rouf et al. (2020)
Apiaceae	*Ammoides verticillata (Desf.) Briq.*	Essential oil	Isothymol, Thymol, Limonene, P-cymene and γ-terpinene)	Abdelli et al., (2021)
Asclepiadaceae	*Pergularia daemia (Forsskal) Chiov.*	Aerial parts	-	Adhikari et al., (2021)
Asclepiadaceae	*Gymnema sylvestre*	All part	gymnemic acids and its	Subramani et al.,

			derivatives	(2020)
Asclepiadaceae	*Tylophora indica*	-	Rutaecarpine	Ramesh et al., (2022)
Asphodelaceae	*Aloe vera (L.) Burm.f.*	Leaf	Feralolide	Mpiana et al., (2020)
Bombacaceae	*Bombax ceiba L.*	Flower	Kaempferol-3-O-(6″-O-E-p-coumaroyl)-β-d-glucopyranoside	Bachar et al., (2021)
Cyperaceae	*Cyperus rotundus L.*	Rhizome	Humulene epoxide, and caryophyllene oxide	Amparo et al., (2021)
Euphorbiaceae	*Phyllanthus emblica* L.	-	Tetra-O-galloyl-β-D-glucose (P), EBDGp	Yi et al., (2004); Pandey et al., (2021)
Fabaceae	*Glycyrrhiza glabra L.*	Root, aerial par	Glycyrrhizic acid, glycosides, coumarin, and cinnamic acid	Lawan et al., (2020)
Lamiaceae	*Ocimum temiflorum*	-	Vicenin, Isorientin 4'-*O*-glucoside 2″-*O*-*p*-hydroxybenzoagte and Ursolic acid	Shree et al., (2022); Mohapatra et al., (2023)
Meliaceae	*Azadirachta indica A.Juss.*	Bark and leaf	Gedunin, pongamol, and azadirachtin	Nesari et al., (2021)
Piperaceae	*Piper nigrum L.*	Seed	Guaiol	Pandey et al., 2021
Rutaceae	*Aegle marmelos (L.) Corrêa*	Leaves, fruits, bark	Seselin	Kaushik et al., (2021); Nivetha et al., (2021); Pandey et al., (2021)
Rutaceae	*Citrus sinensis (L.) Osbeck*	Fruit	Hesperidin, luteolin, and vitamin C	Bellavite and Donzelli, (2020)
Solanaceae	*Withania somnifera*	-	Withanoside V and Somniferine	Shree et al., (2022)
Theaceae	*Camellia sinensis*	-	3-O-Galloylepicatechin-(4Beta-6)-Epicatechin-3-O-Gallate	Ramesh et al., (2022)
Menispermaceae	*Tinospora cordifolia*	Stem, all part	Tinocordiside, Cordifolioside A, Magnoflorine, and Syringin	Shree et al., (2022); Balkrishna et al., (2021); Kulkarni et al., (2022)
Verbenaceae	*Clerodendrum inerme (L.) Gaertn*	-	taraxerol, friedelin and stigmasterol.	Kar, et al., (2021)
Zingiberaceae	*Zingiber officinale Roscoe*	Rhizome	6-gingerol, Geraniin and gingeronone A	Kaushik et al., (2020); Rathinavel et al., 2020
Zingiberaceae	*Curcuma longa L.*	Rhizome	Curcumin, O-Demethyl demethoxycurcumin	Jennings and Parks, (2020); Thimmulappa et al., (2021)

FUTURE PERSPECTIVES

The relationship between viruses and humans has always been a balance between infectivity and lethality, and highly contagious and lethal viruses rarely occur, although recent studies suggest that this is expected to increase in the next few years. Improved hygiene and virological knowledge have helped humans to protect themselves from viruses, but in some densely populated and heavily populated areas with wildlife, viruses and other pathogens can be transmitted from animals. The perfect potion has been created to infect humans. Other changes are even more difficult to overcome (Luo et al., 2020).

In addition to the ominous scenario of climate change accelerating the spread of the virus, unknown long-term symptoms and opportunistic diseases in patients already infected with COVID-19 are also worrisome. Autoimmune diseases have appeared in some patients after recovery from mild to severe Covid-19, and it may be a long time before a good knowledge of the disease and its consequences is achieved. This shows that a long way is needed (Jang et al., 2020; Xian et al., 2020).

Plants are a ubiquitous and unlimited resource that is sometimes used as a treatment and cure for many previous diseases and disease vectors, but once again they are very important to defend against this corona virus and will be effective in future epidemics. Applications such as the use of plant extracts as an adjunct in antiviral therapy, as adjunctive therapies for symptom relief, as protective equipment for health care workers, and as admixtures in disinfectants are still under investigation. Intellectual property publications and results are expected. It will be released in the coming months and years (Lawan et al., 2020).

Herbal medicinal antivirals may restore the optimal balance by enhancing endogenous antioxidant defenses against reactive oxygen species (ROS) and neutralizing viral agents. The ready availability of these compounds has given them great value due to their important role in the prevention of COVID-19.

CONCLUSIONS

Scientists around the world are trying to identify drug molecules that can be used to treat the novel coronavirus disease (COVID-19). Many known broad-spectrum antiviral drugs have been tested through trial and error as first-line treatments. Several vaccines have been prescribed, but their effectiveness against the rapidly emerging strain of SARS-CoV-2 is being evaluated. Plant compounds, including essential oil components, have long been active against a variety of microorganisms, but this approach is still unclear. Recently, the use of herbal medicines against viral infections has gained popularity, and phytochemical studies against SARS-CoV-2 have shown promising potential. Although many of these drug-like compounds have only been evaluated through computational methods, further in vitro and in vivo studies are needed to standardize the inhibitory potency/drug efficacy.

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