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REVIEW ARTICLE

TRADITIONAL TO RECENT APPROACHES IN HERBAL MEDICINE THERAPY OF COVID-19

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ABSTRACT
Coronavirus pneumonia disease (COVID-19) is a newly identified coronavirus strain that causes symptoms ranging from cold-like signs to deaths that reached millions around the world. Until this time, there is no approved vaccine has been invented for clinical use, therefore, developing an effective program for therapy is of high priority to save the lives of patients and protect others from being infected. Nature resembles a huge reservoir of anti-infectious compounds, from which innovative ideas, therapies, and products can be deduced. Chinese herbal medicine had succeeded in the treatment of other coronavirus pneumonia such as SARS, MERS and, H7N9 avian influenza which gives us hope to find the targeted remedy in the traditionally used natural herbs consumed by natives from different regions. This work aims to highlight the use of natural traditional remedies to treat viral pneumonia. This systematic review will include studies of the effects of traditional herbal medicine and its role in the treatment of COVID-19 pneumonia. Although promising results were obtained in many cases, but, only a few studies reported the fractional characterization of bioactive principles and/or mechanisms of action. It is requested that pharmaceutical industries, government agencies, and the scientific community will have a gaze at some of these plants for future research and, to find a potential drug candidates for the development of anti-SARSCoV-2 therapeutics in the near future.
Keywords: COVID-19, influenza, pneumonia, rhinovirus, SARS, traditional medicine.

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INTRODUCTION
Viruses are considered as a reason for many ailments that affect humans worldwide. Most of these ailments are very complex and hard to cure, these viruses include (CV), enterovirus 71 (EV71), dengue virus (DENV), coxsackievirus, herpes simplex virus, hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV), influenza virus, respiratory syncytial virus (RSV)and measles virus (MV), in addition to coronavirus[1]. Coronavirus (COVID-19), pandemic 2019, is considered a newly recognized type of coronavirus that causes severe illness varying from symptoms like flu and reaches to be fatal in a considerable percentage of people across the world [1]. This represents a global challenge as cases are increasing rapidly especially critical cases with pneumonia. Recently, over 81,000 cases, with over 2700 deaths have been reported[2]. The mortality rate is around 2%, most of whom need ICU admission while about 20.1 % have acute respiratory distress syndrome [2]. Therefore, there is an urgent demand to find a quick protocol and strategy for therapy for mild and severe cases. Herbal medicines and purified natural products provide a rich resource for novel remedies where some antiviral drugs have been developed and used in many herbal preparations for therapy. Traditional Chinese medicine has been widely used in China and has already played a major role in the SARS-CoV and SARS-CoV2 outbreaks[3].

In addition, in terms of the composition of herbs for the treatment of paediatric COVID-19, certain herbal formulations adopt the Chinese guidelines[4]. However, compared to adults, the herbs commonly used in the proposed herbal formulations for the treatment of paediatric COVID-19 lack variety[4]. The herbs *Glycyrrhizae* root and rhizome were among the most commonly used herbs in the guidelines for adult treatment of COVID-19[4]. There is also an extensive dependence on traditional medicine in Africa[5]and India[5] and many of them were related to SARS-CoV therapy. The goal of this study was to systematically summarize and examine the herbs commonly used in

the treatment of coronavirus and some associated diseases in many regions of the globe to try to participate in finding a suitable therapy for this fatal virus.

In the current review paper, database searches using PubMed, Elsevier, Scopus, Google Scholar and Web of Science were performed until 10 June 2020 to provide up-to - date reported information.

Table 1: List of some Formulas used in Traditional Chinese Medicine for COVID-19.

Chinese Name	Plant Latin name	Part used
Gancao	*Glycyrrhiza uralensis* Fisch *Glycyrrhiza inflata* Batalin *Glycyrrhiza glabra* L.	Rhizome
Huangqin	*Scutellaria baicalensis* Georgi	Root
Dahuang	*Rheum palmatum* L. *Rheum tanguticum* Maxim. ex Balf. *Rheum officinale* Baill.	Rhizome
Baishao	*Paeonia lactiflora* Pall.	Root
Chenpi	*Citrus reticulata* Blanco	Fruit
Chaihu	*Bupleurum chinense* DC. *Bupleurum scorzonerifolium* Willd	Root
Jiegeng	*Platycodon grandiflorus* (Jacq.) A.DC	Root
Cangzhu	*Atractylodes lancea* (Thunb.) DC. *Atractylodes chinensis* (DC.) Koidz	Rhizome
Danggui	*Angelica sinensis* (Oliv.) Diels	Root
Shengdi	*Rehmannia glutinosa* (Gaertn.) DC	Root
Shigao	Gypsum	
Gegen	*Pueraria lobata* (Willd.) Ohwi	Root
Houpu	*Magnolia officinalis* Rehder & E. H. Wilson *Magnolia officinalis* var. biloba Rehder & E.H.Wilson	Bark
Chuanxiong	*Ligusticum chuanxiong* Hort.	Root
Fangfeng	*Saposhnikovia divaricata* (Turcz.) Schischk.	Root
Sbexiang	*Moschus berezovskii* Flerov. *Moschus sifanicus* Przewalski *Moschus moschiferus* Linnaeus	Musk bag
Huanglian	*Coptis chinensis* Franch. *Coptis deltoidea* C. Y. Cheng et Hsiao *Coptis teeta* Wall.	Rhizome
Qianghuo	*Notopterygium incisum* K. C. Ting ex H. T. Chang *Notopterygium franchetii* H. Boissieu	Rhizome
Xuanshen	*Scrophularia ningpoensis* Hemsl.	Root
Baizhi	*Angelica dahurica* (Hoffm.) Benth. & Hook.f. ex Franch. & Sav.	Root
Renshen	*Panax ginseng* C. A. Mey.	Root
Xionghuang fuling	Realgar *Poria cocos* (Schw.)Wolf	 Scleroaum
Zhiqiao	*Citrus aurantium* L.	Fruit
Maidong	*Ophiopogon japonicus* (Thunb.) Ker Gawl.	Root
Jiangcan	*Beauveria assiana* (Bals.)Vuillant	Silkworm body
Lianqiao	*Forsythia suspensa* (Thunb.) Vahl	Fruit
Zhimu	*Anemarrhena asphodeloides* Bunge	Rhizome
Banxia	*Pinellia ternata* (Thunb.) Makino	Rhizome
Bohe	*Mentha haplocalyx* Briq.	Stem
Zhusha	Cinnabar	
Shengma	*Cimicifuga heracleifolia* Kom. *Cimicifuga dahurica* (Turcz.) Maxim. *Cimicifuga foetida* L.	Rhizome
Mahuang	*Ephedra sinica* Stapf *Ephedra intermedia* Schrenk & C.A.Mey. *Ephedra equisetina* Bunge	Stem
Zhizi	*Gardenia jasminoides* J. Ellis	Fruit
Chantui	*Cryptotympana pustulata* Fabricius	
Tianhuafen	*Trichosanthes kirilowii* Maxim. *Trichosanthes rosthornii* Harms	Root
Shengjiang	*Zingiber officinale* Roscoe	Rhizome
Xixin	*Asarum sieboldii*Miq. *Asarum heterotropoides* F. Schmidt	Rhizome
Huashi	Talcum	
Huoxiang	*Pogostemon amaranthoides* Benth.	Stem

Table 2: Chinese herbal medicines recommendation for pediatric COVID-19.

Stages	Name of herbal formula	Pattern Identification	Composition of herbal formula
Mild	Yin Qiao San	Seasonal epidemic invading the exterior-defense	[#] *Lonicerae* Flos, *Platycodonis* Radix, *Forsythiae fructus*, *Menthae* Herba, *Schizonepetae spica*, *Lophatheri* Herba, *Glycine* Semen *preparatum*, *Phragmitis* Rhizoma, *Arctii* Semen
	Xiang Su San		*Cyperi* Rhizoma, *Citrirereticulatae Pericarpium*, *Perillae folium*,*Glycyrrhizae* Radix et Rhizoma, *Bupleuri* Radix, *Saposhnikoviae* Radix, *Cinnamomi ramulus*, *Osterici seu notopterygii* Radix et Rhizoma
Moderate	Ma Xing Shi Gan Tang + San Ren Tang	Dampness-heat blocking the lung	[#] *Ephedrae* Herba, *Glycyrrhizae* Radix et Rhizoma, *Armeniacae* Semen *amarum*, *Gypsum fibrosum*, *Amomi Fructus rotundus*, *Coicis Semen*, *Magnoliae Cortex*, *Pinelliae Rhizoma praeparatum*, *Talcum*, *Helwingiae* Medulla, *Stachyuri* Medulla, *Lophatheri* Herba
	Buhuan Jin Zhengqi San	Dampness-heat in the spleen and stomach	[#] *Citri Reticulatae Pericarpium*, *Magnoliae* Cortex, *Atractylodis Rhizoma*, *Glycyrrhizae Radix et Rhizoma*, *Pinelliae* Rhizoma, *Agastachis* Herba, *Amomi tsao-ko* Fructus,
Severe	Xuanbai Chengqi Tang + Ganlu Xiaodu Dan	Heat toxin blocking the lung	[#] *Gypsum fibrosum*, *Armeniacae* Semen *amarum*, *Rhei* Radix et Rhizoma, *Trichosanthis fructus*, *Scutellariae* Radix, *Talcum*, *Artemisiae scopariae* Herba, *Fritillariae cirrhosae* Bulbus, *Acori tatarinowii* Rhizoma,*Akebiae caulis*, *Forsythiae fructus*, *Agastachis* Herba,*Amomi fructus* Rotundus, *Belamcandae* Rhizoma,*Menthae* Herba.
	Not available	Intense heat toxin with blockage of bowel Qi and dysphagia	*Rhei* Radix et Rhizoma (Enema using herbal decoction)
Recovered	Liu Junzi Tang + Yu Ping Feng San	Unclear residual heat	[#] *Ginseng Radix*, *Atractylodis macrocephalae Rhizoma*, *Poria sclerotium*, *Citri reticulatae*, *Glycyrrhizae* Radix et Rhizoma, Pericarpium, *Saposhnikoviae* Radix, *Pinelliae* Rhizoma, *Astragali* Radix
	Ma Xing Shi Gan Tang*	Heat toxin fettering the lung	*Ephedrae* Herba 4g, *Anemarrhenae* Rhizoma 9g, *Gypsum fibrosum* 20g, *Armeniacae* Semen *amarum* 10g, *Phragmitis* Rhizoma 10g, *Coicis* Semen 10g,*Platycodonis* Radix 6g, *Lonicerae* Flos 10g, *Mori radicis* Cortex 10g.
	Ma Xing Shi Gan Tang*	Epidemic toxin blocking the lung	*Ephedrae* Herba 4g, , *Anemarrhenae* Rhizoma 9g, *Gypsum fibrosum* 20g,*Armeniacae* Semen *amarum* 10g, *Trichosanthis fructus* 10g, *Coicis* Semen 10g, *Rhei* Radix et Rhizoma 5g, *Lepidii seu descurainiae* Semen 6g, *Mori radicis* Cortex 10g, *Bubali cornu* 10g, *Ginseng* Radix 6g, *Pheretima* 10g.
	Yin Qiao San	Wind-heat invading the lung	*Lonicerae* Flos 15g, *Schizonepetae spica* 10g, *Forsythiae fructus*15g, *Menthae* Herba 10g, *Platycodonis* Radix 10g, *Arctii* Semen 10g, *Scutellariae* Radix 10g, *Angelicae decursivae* Radix 15g, *Trichosanthis pericarpium* 15g, *Belamcandae* Rhizoma 10g, *Artemisiae annuae* Herba 21g, *Eriobotryae folium* 15g.
	Ma Xing Shi Gan Tang	Wind-heat blocking the lung	*Ephedrae* Herba 5g, *Gypsum fibrosum* 15g, *Armeniacae* Semen *amarum* 10g, *Scutellariae* Radix 10g, *Angelicae decursivae* Radix 15g, *Trichosanthis pericarpium* 15g, *Belamcandae* Rhizoma 10g, Pumex 20g, *Eriobotryae folium* 15g, *Lepidii seu descurainiae* Semen 10g, *Artemisiae annuae* Herba 21g, *Pheretima* 10g.
Not reported	Qianjin Weijing Tang + Shangjiao Xuanpi Tang	Dampness-heat fettering the lung	*Phragmitis* Rhizoma 15g, *Coicis* semen 15g, *Benincasae pericarpium* 15g, *Armeniacae* Semen *amarum* 10g, *Trichosanthis pericarpium* 15g, *Scutellariae* Radix 10g, *Angelicae decursivae* Radix 15g, *Eriobotryae folium* 15g, *Belamcandae* Rhizoma 10g,*Curcumae longae* Radix 15g, *Artemisiae annuae* Herba 21g, *Lepidii seu descurainiae* Semen 10g.
	San Ren Tang	Dampness-heat fettering the spleen	*Armeniacae* Semen *amarum* 10g, *Coicis* semen 15g, *Amomi fructus* Rotundus 5g, *Pinelliae* Rhizoma *praeparatum* 10g, *Talcum* 10g, *Magnoliae* Cortex 15g, *Stachyuri* Medulla *Helwingiae* Medulla 5g, *Poria sclerotium* 15g,

* Originally, the name of the herbal formula was not published, and the authors named it on the basis of the Traditional Chinese Medicine Formula Dictionary. [#] Originally, the compositions of the herbal formula were not published, and the authors added them based on the Traditional Chinese Medicine Formula Dictionary.

The following MESH terms were used in the databases referred to above for mining results: traditional herbal medicinal plants for COVID-19, antiviral effects of coronavirus, Chinese herbal medicine, natural products for coronavirus, as well as recently reported mechanisms of action were all gathered from the online bibliographical databases. As there are no known therapies for COVID-19 infection and the production of a preventive vaccine is still under investigation. Thus, to try to minimize the mortality it causes, there is an urgent need to develop effective antivirals for prophylaxis and effective COVID-19 infection control. The exploration of already used therapies in the treatment of this epidemic resembles a quick way to overcome this situation. This study will include a wide overall survey for the effects of traditional herbal medicine, some herbal formulae including their ingredients in addition to recent approaches for the herbal treatment of COVID-19.

Table 3: Medicinal plants reported in the treatment of COVID-19and their mechanism of action.

Plant name	Responsive virus	Mechanism of action	References
Rosa nutkana C. Presl	Corona virus (CoV)	The extract was highly active against an enteric corona virus	25
Amelanchier alnifolia (Nutt.) Nutt. ex M.Roem.	Corona virus (CoV)	The extract was highly active against an enteric corona virus	25
Houttuynia cordata Thunb.	SARS-CoV	- Two primary SARS-CoV proteins, namely chymotrypsin-like protease (3CLpro) and RNA-dependent RNA polymerase (RdRp), were inhibited. -In test animals, it increased CD4 + and CD8 + cell count, indicating its immune-stimulating effect	26
Toona sinensis (Juss.) M. Roem.	SARS-CoV	It inhibited SARS-CoV replication	27
Rheum officinale Baill., *Polygonum multiflorum* Thunb.	SARS-CoV	inhibited the interaction of SARS-CoV (S) protein and ACE2	28
Cibotium barometz (L.) J.Sm. and *Dioscorea batatas* Dence.	SARS-CoV	significant inhibition of SARS-CoV 3CLpro activity	29
Extracts of *(Anthemis hyaline* DC., *Nigella sativa* L., and *Citrus sinensis* (L.) Osbeck)	CoV	They decreased the replication of virus. They increased IL-8 level. Expression of the genes TRPA1, TRPC4, TRPM6, TRPM7, TRPM8 and TRPV4 changed significantly.	30
Isatis indigotica Fortune ex Lindl.	CoV	3CL protease inhibition	31
Houttuynia cordata Thunb.	CoV	Inhibition of the 3CL protease and viral polymerase.	26
Extracts of (*Gentiana scabra* Bunge, *Dioscorea batatas* Dence., *Cassia tora* L., *Taxillus chinensis*(DC.) Danser, *Cibotium barometz* (L.) J.Sm.)	CoV	3CL protease inhibition.	29
Cimicifuga rhizoma, Meliae cortex, Coptidis rhizoma and *Phellodendron cortex*	mouse hepatitis virus A59 (MHV-A59)	The output of MHV and intracellular viral RNA and protein expression was reduced, with EC50 values ranging from 2.0 to 27.5 g/ml. These extracts have significantly reduced the development of PEDV and less dramatically decreased the *in vitro* development of vesicular stomatitis virus (VSV).	32
Sophorae radix, Acanthopanacis cortex, Torilis fructus and *Sanguisorbae radix*	MHV-A59	With comparable reductions in viral proteins and the development of MHV-A59, intracellular viral RNA levels were decreased. The extracts also reduced *in vitro* replication of the MHV strain of John Howard Mueller	33

The use of traditional herbal medicine for the prevention or treatment of this novel viral infection including pneumonia will be investigated. Our research was extended to include most herbs used in this aspect in most regions of the world to provide a collective review with all data required in this field. In searching for the traditionally used therapies some Chinese formulae were found listed in (Table 1) that seem to be effective[7.] It was found that *Glycyrrhizae* spp. root and rhizome is considered as one of the most used herbs in several herbal formulas followed by *Scutellariae* root and rhizome then come *Rheum* spp. These formulas were used for the treatment of several symptoms of some patients of COVID-19 as high fever and diarrhea syndromes[7.] It was declared at a press conference in April 2020 by a Chinese official that three patent drugs of herbal constituents were approved for the treatment of COVID-19 manifestations. These include Xuebijing injections when the cases are severe in addition to Jinhuaqinggan granules and Lianhuaqingwen. After this approval, these drugs were propagated and widely used in China for the treatment of COVID-19. It was stated that these patents relieve some symptoms as fever, cough, fatigue also it decreases the risk that these cases develop to be severe but no other details were added[8.]

Table 4: Medicinal plants used in traditional medicine to treat upper respiratory viral infections.

Plant name	Responsive virus	Mechanism of action	References
Polyphenols from *Punica granatum* L.	Influenza A virus	Viral replication suppression against influenza A virus	34,35
Polyphenols of *Berries* extract	Influenza virus	Modification of immunity and improvement in the role of T cells against influenza virus and common cold	36-41
Glycyrrhizin isolated from *Glycyrrhiza uralensis* Fisch, *Glycyrrhiza inflata* Batalin and *Glycyrrhiza glabra* L.	influenza virus A2 (H2N2), H5N1 virus	Stimulation of T-cell development of interferon-gamma, immunomodulation, anti-inflammatory reduction of virus uptake by host cells against influenza A2 (H2N2), H5N1 and influenza A viruses	7,42-44
Maoto **(***Ehedra* herba, *Cinnamomi* cortex, *Armenicae* semen and *Glycyrrhizae* radix**)**	Influenza virus	They help virus-bound natural antibodies against seasonal influenza	45,46
Echinacea spp.	Influenza, rhinovirus	inflammation modulators in cells infected with influenza, rhinovirus, and other respiratory viruses	17
Camellia sinensis (L.) Kuntze	Influenza	Influenza Increase levels of T- lymphocytes	26
Potentilla arguta Pursh	Syncytial virus (RSV)	Fully inhibited syncytial respiratory virus (RSV)	25
Sambucus racemosa L.	Syncytial virus (RSV)	completely inhibited respiratory syncytial virus (RSV)	25
Ipomopsis aggregate (Pursh) V.E. Grant	Parainfluenza	Good activity against parainfluenza virus type 3was demonstrated.	25
Lomatium dissectum (Nutt.) Mathias & Constance	Rotavirus	The cytopathic effects of rotavirus were completely inhibited	25
Berries extract	Influenza virus	Modification of immunity and improvement in the role of T cells against influenza virus and common cold	36-41
Clinacanthus siamensis Bremek.	Influenza virus	Enhancement of the development of anti-influenza IgG and IgA antibodies against influenza viruses	47
Punica granatum L.	Influenza A virus	Suppression of Viral Replication against Influenza A virus	34,35
Psidium guajava L.	Influenza A (H1N1)	virucidal inhibition of viral hemagglutination against influenza A (H1N1)	48
Epimedium koreanum Nakai	Influenza A subtypes (H1N1, H5N2, H7N3, H9N2)	Reduction in viral replication, enhancement of type I interferon secretion and pro-inflammatory cytokines, influenza A subtype immunomodulation (H1N1, H5N2, H7N3, H9N2),	49
Scutellaria baicalensis Georgi	Influenza A virus	Inhibitor of neuraminidase, prevention of virus budding against Influenza A virus and common cold	50
Paeonia lactiflora Pall.	Influenza virus	It inhibits viral RNA and viral protein synthesis, viral hemagglutination, viral binding and penetration into host cells against influenza viruses.	51
Allium sativum L.	Parainfluenza, rhinovirus	-	17,52
Forsythia suspense (Thunb.) Vahl	RSV	-	53
Geranium sanguineum L.	Influenza	-	54
Lonicera japonica Thunb.	Influenza	-	55
Pelargonium sidoides DC.	Influenza Coronavirus, Coxsackie, parainfluenza Rhinovirus, RSV	-	56,57
*Pinus*spp.	Influenza	-	58,59
Prunella vulgaris L.	Influenza	-	60
Rosmarinus officinalis L.	RSV	-	61
Salvia spp.	Influenza	-	62
Sambucus spp.	Influenza (fruit) Rhinovirus (fruit) RSV (branch tip)	-	63,65
Thuja spp.	Parainfluenza, Influenza	-	58

Table 5: List of some secondary metabolites against viral respiratory tract infections.

Compound name	Responsive virus	Mechanism of action	References
Concanavalin A isolated from *Canavalia ensiformis* (L.)DC.	CoV	This induced hemagglutinating encephalomyelitis CoV inactivity, probably by binding to glycosylated membrane proteins that assist the virus in host cell recognition.	66
Lycorine isolated from *Lycoris radiate* (L'Hér.) Herb.	SARS-CoV	SARS-CoV with an EC_{50} value of 5.7 nM was inhibited	31
Emodin isolated from *Rheum officinale* Baill. and *Polygonum multiflorum* Thunb.	SARS-CoV	The interaction of the SARS-CoV(S) and ACE2 proteins with IC_{50} values ranging from 1 to 10 μg/mL for extracts and 200 μM for emodinamide was inhibited.	28
Tetrandrine	HCoV-OC43-infected MRC-5 human lung cells	In HCoV-OC43-infected MRC-5 human lung cells with IC_{50} values of 0.33, 1.01, and 0.83 μM , respectively, early stage viral-induced cell death was significantly inhibited.	67
Fangchinoline	HCoV-OC43-infected MRC-5 human lung cells	n HCoV-OC43-infected MRC-5 human lung cells with IC_{50} values of 0.33, 1.01 and 0.83 μM, respectively, early stage viral-induced cell death was significantly inhibited.	67
Cepharanthine	HCoV-OC43-infected MRC-5 human lung cells	n HCoV-OC43-infected MRC-5 human lung cells with IC_{50} values of 0.33, 1.01 and 0.83 μM, respectively, early stage viral-induced cell death was significantly inhibited.	67
8*β*-Hydroxyabieta-9(11),13-dien-12-one	SARS-CoV	It inhibited the activity of SARS-CoV 3CLpro with SI > 6677	68
Savinin	SARS-CoV	It inhibited the activity of SARS-CoV 3CLpro with SI > 6677	68
Betulinic acid	SARS-CoV	They were competitive SARS-CoV 3CLpro inhibitors with Ki values of 8.2 and 9.1 μM	68
Halituna isolated from marine alga *Halimeda tuna*	Coronavirus A59	It exhibited antiviral effect against murine coronavirus A59	69
Tanshinone I isolated from *Salvia miltiorrhiza* Bunge	SARS-CoV 3	This inhibited the infection and replication of SARS-CoV 3CLpro and papain-like protease (PLpro) at 1-1000 μM	70
Tannic acid isolated from black tea	SARS-CoV	Inhibitory effects were observed on SARS-CoV 3CLpro with an IC_{50} value of 3 μM and 3 μM , respectively.	71
3-Isotheaflavin-3-gallate isolated from black tea	SARS-CoV	Inhibitory effects were observed on SARS-CoV 3CLpro with an IC_{50} value of 3 μM and 7 μM, respectively.	71
Theaflavin-3,3′-digallate isolated from black tea	SARS-CoV	Inhibitory effects were observed on SARS-CoV 3CLpro with an IC_{50} value of 3 μM and 9.5 μM , respectively.	71
Theaflavin isolated from black tea	bovine CoV, bovine rotavirus	Bovine rotavirus and bovine corona virus infections have been ne utralised.	72
Sinigrin isolated from *Isatis indigotica* Fortune ex Lindl.	SARS-CoV	An inhibitory effect on SARS-CoV 3CLpro with an IC_{50} value of 217μM has been shown.	73
Indigo isolated from *Isatis indigotica* Fortune ex Lindl	SARS-CoV	It showed an inhibitory effect on 3CLpro SARS-CoV with an IC_{50} value of 752 μM.	73
Aloe emodin isolated from *Isatis indigotica* Fortune ex Lindl	SARS-CoV	An inhibitory effect on SARS-CoV 3CLpro with an IC_{50} value of 8.3μM has been shown.	73
Hesperetin isolated from *Isatis indigotica* Fortune ex Lindl	SARS-CoV	An inhibitory effect on SARS-CoV 3CLpro with an IC_{50} value of 365 μM was seen.	73
β-sitosterol isolated from *Isatis indigotica* Fortune ex Lindl	SARS-CoV	An inhibitory effect was demonstrated on SARS-CoV 3CLpro with an IC_{50} value of 1210 μM.	73
Amentoflavone isolated from *Torreya nucifera* (L.) Siebold & Zucc.	SARS-CoV	It exhibited inhibitory effects with an IC_{50} value of 8.3μM on SARS-CoV 3CLpro.	74
Apigenin isolated from *Torreya nucifera (L.) Siebold & Zucc*	SARS-CoV	It exhibited inhibitory effects with an IC_{50} value of 280.8 μM on SARS-CoV 3CLpro.	74
Luteolin isolated from *Torreya nucifera (L.) Siebold & Zucc*	SARS-CoV	It exhibited inhibitory effects with an IC_{50} value of 20.2 μM on SARS-CoV 3CLpro.	74

Cont…

Quercetin isolated from *Torreya nucifera* (L.) *Siebold & Zucc*	SARS-CoV	It exhibited inhibitory effects with an IC_{50} value of 23.8 μM on SARS-CoV 3CLpro.	74
Myricetin	SARS-CoV	The inhibitory effect of SARS-CoV 3CLpro was 0.01-10 μMM.	75
Scutellarein	SARS-CoV	It exerted SARS-CoV 3CLpro inhibitory effect at 0.01–10 μM	75
Broussochalcone B isolated from *Broussonetia papyrifera* (L.) L'Hér. ex Vent.	SARS-CoV	It inhibited both SARS-CoV 3CLpro and PLpro	76
Broussochalcone A isolated from *Broussonetia papyrifera* (L.) L'Hér. ex Vent.	SARS-CoV	It inhibited both SARS-CoV 3CLpro and PLpro	76
4-Hydroxyisolonchocarpin isolated from *Broussonetia papyrifera* (L.) L'Hér. ex Vent.	SARS-CoV	It inhibited both SARS-CoV 3CLpro and PLpro	76
Papyriflavonol A isolated from *Broussonetia papyrifera* (L.) L'Hér. ex Vent.	SARS-CoV	It inhibited both 3CLpro and PLpro of SARS-CoV. Among isolated compounds from the same plant, the highest inhibition was shown against PLpro with an IC_{50} value of 3.7 μM .	76
3′-(3-methylbut-2-enyl)-3′,4,7-trihydroxyflavane isolated from *Broussonetia papyrifera* (L.) L'Hér. ex Vent.	SARS-CoV	It inhibited both SARS-CoV 3CLpro and PLpro	76
Kazinol A isolated from *Broussonetia papyrifera* (L.) L'Hér. ex Vent.	SARS-CoV	It inhibited both SARS-CoV 3CLpro and PLpro	76
Kazinol B isolated from *Broussonetia papyrifera* (L.) L'Hér. ex Vent.	SARS-CoV	It inhibited both SARS-CoV 3CLpro and PLpro	76
Broussoflavan A isolated from *Broussonetia papyrifera* (L.) L'Hér. ex Vent.	SARS-CoV	It inhibited both SARS-CoV 3CLpro and PLpro	76
Kazinol F isolated from *Broussonetia papyrifera* (L.) L'Hér. ex Vent.	SARS-CoV	It inhibited both SARS-CoV 3CLpro and PLpro	76
Kazinol J isolated from *Broussonetia papyrifera* (L.) L'Hér. ex Vent.	SARS-CoV	It inhibited both SARS-CoV 3CLpro and PLpro	76
Saikosaponin A	CoV‑229E	It exhibited activity with an EC_{50} value of 8.6 μM against human CoV-229E.	77
Saikosaponin B_2	CoV‑229E	It exhibited activity with an EC_{50} value of 8.6, 1.7μM against human CoV-229E. Viral attachment and penetration stages were inhibited.	77
Saikosaponin C	CoV‑229E	It exhibited activity with an EC_{50} value of 19.9 μM against human CoV-229E.	77
Saikosaponin D	CoV‑229E	It exhibited activity with an EC_{50} value of 13.2 μM against human CoV-229E.	77
Ginsenoside Rb1 isolated from *Panax ginseng* C.A.Mey.	SARS-CoV	Antiviral activity demonstrated at 100 μM	78
Actinomycin D isolated from *Streptomyces parvulus* bacteria	CoV	At 5-25 μM with an EC_{50} value of 0.02 μM, the inhibited CoV attachment and penetration stages	77
Homoharringtonine	Murine coronavirus	It was the most potent alkaloid among 727 compounds with an IC_{50} of ~11 nM	79
Tylophorine isolated from *Tylophora indica* (Burm. f.) Merr.	CoV	Inhibited the activity of N and S proteins as well as viral replication of transmissible gastroenteritis virus enteropathogenic coronavirus	80
7-Methoxycryptopleurine isolated from *Tylophora indica* (Burm. f.) Merr.	CoV	It inhibited the activity of N and S proteins as well as viral replication of the transmissible gastroenteritis virus enteropathogenic coronavirus.	80
Cepharanthine	SARS-CoV	It inhibited the protease enzyme SARS-CoV at 0.5–10 μg / mLL	81
Berbamine	HCoV-NL63	With an IC_{50} value of 1.48 μM, it inhibited HCoV-NL63	82
Lycorine	HCoV-OC43	Cell division was inhibited and RNA, DNA and protein synthesis were inhibited, respectively.	82
Emetine	HCoV-OC43	Cell division was inhibited and RNA, DNA and protein synthesis were inhibited, respectively.	82
Mycophenolate mofetil	HCoV-OC43	The immune suppressing effect was exerted on the CoV species	82

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Eckol isolated from *Ecklonia cava*	Porcine epidemic diarrhea coronavirus	The virus binding to porcine epidemic cells was blocked at 1-200 μM with IC_{50} values of 22.5, 18.6, 12.2, and 14.6 μM, respectively.	83
7-phloroeckol isolated from *Ecklonia cava*	Porcine epidemic diarrhea coronavirus	The virus binding to porcine epidemic cells was blocked at 1 to 200 μM with IC_{50} values of 22.5, 18.6, 12.2 and 14.6 μM, respectively.	83
Phlorofucofuroeckoln isolated from *Ecklonia cava*	Porcine epidemic diarrhea coronavirus	The virus binding to porcine epidemic cells was blocked at 1-200 μM with IC_{50} values of 22.5, 18.6, 12.2 and 14.6 μM, respectively.	83
Dieckol isolated from *Ecklonia cava*	Porcine epidemic diarrhea coronavirus	The virus binding to porcine epidemic cells was blocked at 1-200 μM with IC_{50} values of 22.5, 18.6, 12.2 and 14.6 μM respectively.	83
Procyanidin A2 isolated from *Cinnamomi cortex*	SARS-CoV	It inhibited infection with SARS-CoV at 0-500 μM	84
Procyanidin B1 isolated from *Cinnamomi cortex*	SARS-CoV	It inhibited infection with SARS-CoV at 0-500 μM	84
Cinnamtannin B1 isolated from *Cinnamomi cortex*	SARS-CoV	It inhibited infection with SARS-CoV at 0-500 μM	84
Tetra-*O*-galloyl-beta-*D*-glucose	SARS-CoV	It blocked the host cell entry of SARS-CoV at 0–10–3 mol/L	85
Luteolin	SARS-CoV	It blocked SARS-CoV's host cell entry at 0-10-3 mol/L.	85
Tetra-*O*-galloyl-beta-*D*-glucose	SARS-CoV	It blocked SARS-CoV's host cell entry at 0-10-3 mol/L.	85
Bavachinin isolated from *Psoralea corylifolia* L.	SARS-CoV	It inhibited papain-like protease of SARS-CoV	86
Neobavaisoflavone isolated from *Psoralea corylifolia* L.	SARS-CoV	It inhibited papain-like protease of SARS-CoV	86
Isobavachalcone isolated from *Psoralea corylifolia* L.	SARS-CoV	It inhibited papain-like protease of SARS-CoV	86
4'-*O*-methylbavachalcone isolated from *Psoralea corylifolia* L.	SARS-CoV	It inhibited papain-like protease of SARS-CoV	86
Psoralidin isolated from *Psoralea corylifolia* L.	SARS-CoV	It inhibited papain-like protease of SARS-CoV	86
Corylifol isolated from *Psoralea corylifolia* L.	SARS-CoV	It inhibited papain-like protease of SARS-CoV	86
Psoralidin isolated from *Psoralea corylifolia* L.	SARS-CoV	A significant protease inhibitory effect on SARS-CoV with an IC_{50} value of 4.2 μM was observed.	28
Emodin isolated from *Psoralea corylifolia* L.	SARS-CoV	It inhibited the interaction between the protein SARS-CoV(S) and ACE2 at 0-400 μM	28
Juglanin	SARS-CoV	It blocked the SARS-CoV 3a channel with an IC_{50} value of 2.3 μM	87
Tomentin A isolated from *Paulownia tomentosa* Steud.	SARS-CoV	It inhibited PLpro of SARS-CoV at 0–100 μM	88
Tomentin B isolated from *Paulownia tomentosa* Steud.	SARS-CoV	It inhibited PLpro of SARSCoV at 0–100 μM	88
Tomentin C isolated from *Paulownia tomentosa* Steud.	SARS-CoV	It inhibited PLpro of SARS-CoV at 0–100 μM	88
Tomentin D isolated from *Paulownia tomentosa* Steud.	SARS-CoV	It inhibited PLpro of SARS-CoV at 0–100 μM	88
Tomentin E isolated from *Paulownia tomentosa* Steud.	SARS-CoV	It inhibited PLpro of SARS-CoV at 0–100 μM	88
3′-*O*-methyldiplacol isolated from *Paulownia tomentosa* Steud.	SARS-CoV	It inhibited PLpro of SARS-CoV at 0–100 μM	88
4′-*O*-methyldiplacol isolated from *Paulownia tomentosa* Steud.	SARS-CoV	It inhibited PLpro of SARS-CoV at 0–100 μM	88
3′-*O*-methyldiplacone isolated from *Paulownia tomentosa* Steud.	SARS-CoV	It inhibited PLpro of SARS-CoV at 0–100 μM	88
4′-*O*-methyldiplacone isolated from *Paulownia tomentosa* Steud.	SARS-CoV	It inhibited PLpro of SARS-CoV at 0–100 μM	88

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Mimulone diplacone isolated from *Paulownia tomentosa* Steud.	SARS-CoV	It inhibited PLpro of SARS-CoV at 0–100 μM	88
6-geranyl-4′,5,7-trihydroxy-3′,5′- dimethoxyflavanone isolated from *Paulownia tomentosa* Steud.	SARS-CoV	It inhibited PLpro of SARS-CoV at 0–100 μM	88
(−)-Catechin gallate	SARS-CoV	It inhibited the SARS-CoV nanoparticle-based RNA oligonucleotide at 0.001-1 μg/mL	89
(−)- Gallocatechin gallate	SARS-CoV	It inhibited the SARS-CoV nanoparticle-based RNA oligonucleotide at 0.001–1 μg/mL	89
Quercetin isolated from *Houttuynia cordata* Thunb.	murine CoV	It operates at 15.63–500 μg/mL against murine CoV.	90
Rutin isolated from *Houttuynia cordata* Thunb.	murine CoV	It operates at 15.63–500 μg/mL against murine CoV.	90
Cinanserin (1 and 2 dpi) isolated from *Houttuynia cordata* Thunb.	murine CoV	It operates at 15.63–500 μg/mL against murine CoV.	90
Sivestrol isolated from *Aglaia foveolata* Pannell	HCoV-229E	With an IC_{50} of 40 nM, it inhibited cap-dependent viral mRNA translation of HCoV-229E at 0.6–2 μM	91
Ferruginol isolated from *Sequoia sempervirens* (D.Don) Endl.	SARS-CoV	It greatly inhibited replication of SARS-CoV at 0-80 μM	92
3*β*,12-diacetoxyabieta-6,8,11,13-tetraene isolated from *Sequoia sempervirens* (D.Don) Endl.	SARS-CoV	It greatly inhibited replication of SARS-CoV at 0-80 μM	92
Betulonic acid isolated from *Sequoia sempervirens* (D. Don) Endl.	SARS-CoV	It greatly inhibited replication of SARS-CoV at 0-80 μM	92
Betulinic acid isolated from *Sequoia sempervirens* (D. Don) Endl.	SARS-CoV	It greatly inhibited replication of SARS-CoV at 0-80 μM	92
Hinokinin isolated from *Sequoia sempervirens* (D. Don) Endl.	SARS-CoV	It greatly inhibited replication of SARS-CoV at 0-80 μM	92
Savinin isolated from *Sequoia sempervirens* (D. Don) Endl.	SARS-CoV	It greatly inhibited replication of SARS-CoV at 0-80 μM	92
Curcumin isolated from *Sequoia sempervirens* (D. Don) Endl.	SARS-CoV	It greatly inhibited replication of SARS-CoV at 0-80 μM	92
Quabain	Gastroenteritis coronavirus (TGEV)	It lowered both viral titers and viral yields and decreased the number of copies of viral RNA to 0-3000 nM	93
Tylophorine isolated from *Tylophora indica* (Burm. f.) Merr.	CoV	It prevented viral replication in swine testicular cells infected with CoV.	80
7-methoxycryptopleurine isolated from *Tylophora indica* (Burm. f.) Merr.	CoV	Viral replication was inhibited in CoV-infected testicular swine cells	80
Tylophorine	CoV	It targeted replication of viral RNA and cellular JAK2 mediated dominant activation of NF-κB in CoV at 0-1000 nM	94

Glycyrrhizae rhizoma is considered from the highly effective herbs widely used whatever is the stage of infection. It is approved as an antiviral herbal therapy by the China Food and Drug Administration (SFDA). Its mechanism was reported by many studies as it inhibits attachment, entry, and replication of the virus which was earlier used in treating SARS[9,10]. In addition, *Glycyrrhizae* Radix Rhizoma possesses an anti-inflammatory effect which is useful in the treatment of lung inflammatory cases associated with COVID-19[4,11]. A herbal formula called Qingfei Paidu Tang was recommended for the treatment of extreme COVID-19 conditions in the Korean Guidelines, as well as its recommendation in the national Chinese guidelines for diagnosis and treatment. This formula consists of (*Ephedrae* Herba 9g, *Armeniacae* Semen *amarum* 9g, *Glycyrrhizae* Rhizoma 6g, *Gypsum fibrosum* 15~30 g, *Alismatis* Rhizoma 9g, *Cinnamomi ramulus* 9g, *Polyporus* 9g, *Poria sclerotium* 15g, *Atractylodis macrocephalae* Rhizoma 9g, *Bupleuri* Radix 16g, *Pinelliae* Rhizoma 9g, *Scutellariae* Radix 6 g, *Zingiberis* Rhizoma Recens 9g, *Farfare* Flos 9 g, *Asteris* Radix 9g, *Belamcandae* Rhizoma 9g, *Dioscoreae* Rhizoma 12g, *Asari* Herba 6g, *Aurantii*

fructus 6g, *Agastachis* Herba 9 and *Citri unshius* Pericarpium 6g). Recently, it was reported by[12,] that this formula boosts immunity and decreases inflammation through its effect on the lung and spleen which are considered the pathways of COVID-19. In addition, the Korean guidelines removed the *Farfarae* Flos herb due to its safety and toxicity[4.] Ang *et al.*, presented several herbal formulas used in traditional medicine for pediatric COVID-19 cases (Table 2). They mentioned 13 herbal formulas approved by the Chinese guidelines which consist totally of 56 herbs. According to the authors, clusters of herbal pairs were used *Artemisiae annuae* herb and *Scutellariae* root in a cluster, *Armeniacae* seeds, and *Coicis* seeds in another and *Ephedrae* with *Gypsum fibrosum*.[13.]

Table 6: List of Indian medicinal plants and their active compounds as a best therapeutic tool to treat different viral diseases.

Medicinal Plant	Active principle	Antiviral mechanism of action	Reference
Acacia nilotica (L.) Delile	Quercetin	Inhibition HIV-PR	
Allium sativum L.	Allicin	Proteolytic and hemagglutinating activity and viral replication	
Andrographis paniculata (Burm.f.) Nees	Andrographolide	Antiviral potential	
Clitoria ternatea L.	Delphinidin-3-O-glucoside	Antiviral properties	
Cynara scolymus L.	Cynaratriol	ACE inhibitor	
Embelia ribes Burm.f.	1,4- benzoquinone	Inhibition of ACE	
Eugenia jambolana Lam.	Ellagic acid	Protease Inhibitor	
Euphorbia granulata Forssk.	Gallic acid	HIV inhibitory	
Gymnema sylvestre (Retz.) R.Br. ex Sm.	Tartaric acid	Inhibition of viral DNA synthesis	5
Hyoscyamus niger L.	Hyoscyamine	Viral Inhibition and Bronchodilator	
Ocimum kilimandscharicum Gürke	Camphor	Inhibitory action towards HIV-1	
Punica granatum L.	Punicalagin	Inhibited viral Glycoprotein & Anti-HSV-1	
Sphaeranthus indicus L.	Tartaric acid	Inhibition of Mouse corona virus Various compositions and Herpes virus -Bronchodilation	
Strobilanthes cusia (Nees) Kuntze	Lupeol	Inhibitory action towards HCoV-NL63	
Vitex negundo L.	Sabinene	Inhibitory action against HIV	
Vitex trifolia L.	Casticin	Immunomodulatory & Anti-inflammatory effect on lungs	

Traditional medicine plays a major role in supplying communities with treatment in Africa. Medicinal plants such as *Artemisia annua* are known to be one of the potential therapies for COVID-19, which should be tested for effectiveness and adverse side effects. The WHO suggested testing herbs for their effectiveness and protection before conventional practice through comprehensive clinical trials is crucial [14], In the meantime, conventional medicine continues to be generally used across Africa. President Rajoelina estimated that 80 percent of the population of Madagascar uses 'COVID Organics'[15.] A biochemist researcher in traditional medicine at North-West University in South Africa, Professor Chrisna Gouws, reported about the use of *Artemisia annua* in herbal medicine "It's a very common herbal medicine. In parts of the world, it is one of the most commonly used herbs. The scientific community has been interested in artemisinin, which is a known anti-malarial medication, since it contains"[15.] Collaborating with Artemi Life Inc., a US-based business and medical researchers in Denmark and Germany, the Max Planck Institute of Colloids and Interfaces, Potsdam (Germany), will be studying *Artemisia annua* extract and artemisinin derivatives in laboratory cell studies against the novel SARS-CoV-2 coronavirus[15.]

Furthermore, there are several medicinal plants and many secondary metabolites that were reported effective against viral respiratory tract infections. For example, (Table 3) explains some of medicinal plants that possessed antiviral activity against different coronavirus types and their possible mechanism of actions. While (Tables 4 and Table 5) included various herbal medicines and different secondary metabolites which reported to have activity against causes of viral respiratory infection, specially corona virus.

Among these plants, the Lamiaceae family herbs, which have a completely different chemistry, primarily monoterpenoids. According to a previous study[17] *Salvia apiana* (white sage), *S. officinalis* (garden sage), *Thymus vulgaris* (thyme), *Rosmarinus officinalis* (rosemary), and *Prunella vulgaris* (heal-all) are among the many other mints with antiviral and other beneficial effects relevant to viral respiratory infections. Generally, these are received well by patients based on taste[17.] Trees from two evergreen families, the Pinaceae and Cupressaceae, make up another family groups of antivirals. *Pinus spp.* (pine), Abies spp. (true firs), *Picea spp.* (spruces), *Thuja spp.* (cedars), and *Juniperus* spp. (junipers) resin and branch tips are all antiviral and inflammatory modulators with a respiratory tract affinity. All these groups are inflammation modulators, which is important for two reasons. The symptoms of viral respiratory infections are significantly due to immune responses to the infecting virus. More importantly, severe influenza is in part due to what has been dubbed "cytokine storm": a hyper-reaction of the immune system to certain influenza strains.Thus, inflammation-modulating herbs are significant to decrease symptoms and to prevent severe consequences, at least in the case of influenza infection. Additionally, these herbs considerably have immune-stimulating effects, running the risk of rising symptoms of viral respiratory infections or making cytokine storms worse[17.]

Balachandar and his colleagues reported a strategy in India to establish an effective method of viral inactivation by exploiting and infusing active compounds from naturally occurring medicinal plants into respiratory masks based on nanofiber. They listed some of the Indian medicinal plants (Table 6) that could be used as potent antiviral agents[18.] Moreover, Thangadurai *et al*., reported that Siddha or Ayurvedha traditional medicine validated a polyherbal formulation Deva chooranam (DC) with proven preclinical safety and activity against HIV and may have possible activity for the prevention and management of 2019-nCoV infection. This herbal formula includes three medicinal herbs: *Cedrus deodara* (Devadaru), *Cinnamomum tamala* (Lavanga pathiri) and*Alpinia galanga* (Arathai)[19.]

RECENT APPROACHES FOR TREATMENT

Recently, a study published by Ren *et al.*, showed that 574 prescriptions with the key words "Warm diseases (Wenbing)", "Pestilence (Wenyi or Yibing)" or "Epidemic diseases (Shiyi)" were obtained among 96606 classical prescriptions.[7.] Meanwhile, among the 574 prescriptions, there were 40 forms of Chinese Medicines (CMs), 36 CMs-pairs, 6 triple-CMs-groups, with high frequency.Also, the primary targets of SARS-COV-2, namely 3CL hydrolase (Mpro) and angiotensin-converting enzyme 2(ACE2), were used to dock the main constituents from the 40 kinds by the Ligand FitDock method. The COVID-19 targets were docked with a total of 66 higher frequency compounds distributed in 26 forms of CMs, of which Gancao (*Glycyrrhizae* Radix et rhizoma), Dahuang (*Rhei* radix et rhizome), HuangQin (*Scutellariae* radix) and Chaihu (*Bupleuri* radix) contained more potential compounds. In addition, the results of the network pharmacology showed that pairs of Chinese medicines HuangQin (*Scutellariae* radix)and Gancao (*Glycyrrhizae* radix et rhizoma) might interact with targets for immune and inflammatory diseases[7.]

In another study conducted by chen *et al.*, two key proteins, 3C-like protease (3CLpro) and angiotensin-converting enzyme 2 (ACE2), could be used as targets for active constituents *in silico* screening that stop SARS-COV-2replication and proliferation, profit from rapid SARS-COV-2 sequencing coupled with molecular modelling based on the genomes of associated viral proteins[20,21]. Owis *et al.*, reported that ten flavonoids that were isolated from *Salvadora persica* L. aqueous extract showed remarkable binding stability at the N3 binding site of main protease of the COVID-19 to different degrees when compared with darunavir, a COVID-19 main protease inhibitor. The isolated and identified flavonoids were similar in structure which gave the opportunity to deduce the relation between their structure and the affinity to the receptors of the N3 binding site. The findings showed that the fundamental flavonol as a nucleus itself possesses an activity, in addition, the presence of rutinose in position 3 in this nucleus and the absence of O-CH_3 group in ring B may be an explanation for improving the binding stability[22.] According to Khattab *et al*., cathepsins and furin, may be used for developing broad-spectrum anti-SARS-CoV therapies which target multiple viral and non-viral proteins[23.] A recent study by Qamar and his colleagues analyzed the 3CLpro sequence of CoV-19, developed its 3D homology model, and screened it against a library of medicinal plant containing 32,297 possible anti-viral phytochemicals/ traditional Chinese medicinal compounds and selected the top nine hits that may inhibit the action of SARS-CoV-2 3CLpro and therefore virus replication[24]. These compounds were 5,7,3′,4′-Tetrahydroxy-2′-(3,3- dimethyl allyl) isoflav - one, myricitrin, methyl rosmarinate, 3,5,7,3′,4′,5′-hexahydroxy flavanone-3-*O*-*β*-D-glucopyranoside, (2*S*)-eriodictyol 7-*O*-(6″-*O*-galloyl)- *β*- Dglucopyrano-side, calceolarioside B, myricetin 3-*O*-*β*-*D*-glucopyranoside, licoleafol and amaranthin with docking scores -16.35, -15.64, -15.44, -14.42, -14.41, -14.36, -13.70, -13.63 and -12.67, respectively, compared to nelfinavir (-12.20), prulifloxacin (-11.32) and colistin (-11.73).

CONCLUSION

From the above reviewed studies, it is evident that different countries around the world have abundance of antiviral plants resources based on scientific findings. There are several medicinal plants traditionally used by the local people of many countries all over the world to treat coronavirus. However, there is a great deficiency to find enough studies considering the chemistry and pharmacological effects of these herbal plants. Therefore, carrying detailed ethnomedicinal studies is of great demand to discover novel active principles

with promising activity against this fatal virus. Besides, very few herbs have been screened *in vitro* and *in vivo* against viruses including coronavirus, so, pharmaceutical industries and/or government agencies should support more research activities in this area in order to utilize these antiviral medicinal plants for a solution against the global fatal illness (COV-19) or any threaten viral infections.

CONFLICTS OF INTEREST

The authors have no conflicts to report.

AUTHORS' CONTRIBUTIONS

The two authors shared the research ideas, collected data, wrote the article, revised the article grammatical correction and reviewed the whole article.

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