

INDIAN HERBAL PLANT PREPARATIONS USED AS SOURCE OF DRUGS AGAINST NOVEL COVID-19.

Navroop Kaur^{1*}, Charu Tomar², Premnidhi Yadav², Deepali Vashisth², MS Laxmi², Vedanshi Sharma², Mohit Chaudhary², Jaya Malik², Akshay Bharti², Aniket Raj², Pragati Kushwaha² and Om Prakash Tiwari²

¹Reader, Department of Microbiology, I.T.S. Centre for Dental Studies & Research, NH-58, Delhi-Meerut Road, Ghaziabad, Uttar Pradesh, INDIA Phone no-+91-9810406018.

²Noida International University, Gautam Budha Nagar-201308, Greater Noida, Uttar Pradesh, India.

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*Corresponding Author

Dr. Navroop Kaur

Reader, Department of Microbiology, I.T.S. Centre for Dental Studies & Research, NH-58, Delhi-Meerut Road, Ghaziabad, Uttar Pradesh, INDIA Phone no-+91-9810406018.

navroop.saggu9@gmail.com,

navroopkaur@its.edu.in

ABSTRACT

India has a long history and strong base for ayurvedic plants, which is a traditional herbal medicinal system. Herbal plants play an important role in preventing and treating human diseases. Plants are related to the event of human civilization round the whole world. In recent years, there has been growing interest in alternative therapies and therefore the therapeutic use of natural products, especially those derived from plants. Plants are considered as one of the main sources of biologically active materials. Plants are considered as rich sources of phytochemical ingredients that enable them to possess medicinal value. Medicinal plants are a potential source for the development of new herbal drug. In the 21st century, the pharmacological effects of medicinal plants are considered a promising future drug/medicine for the management of health care. A number of the medicinal plant have been subjected to detail chemical investigations, and this has led to the isolation of pure bioactive molecules which have been the emergence of the new era of the health care system to treat human disease in the future awareness of the traditional knowledge, and the medicinal plant can play a key role in the exploitation and discovery of natural plant resources. Therefore, this review was conducted to research and describe the method of using medicinal plants throughout history. The aim of the present review is to understand the knowledge of medicinal plants as a future source of herbal drugs.

KEYWORDS: Ayurveda, Indian Herbal Plants, drug development, COVID-19.

INTRODUCTION

In a recent scenario, the reasons for the usage of specific “medicinal plants” for treatment of certain diseases were being discovered. The medicinal plant usage gradually abandoned the empiric framework and became founded on explicatory facts. Despite that, the decreasing efficacy of synthetic drugs and the increasing contradictions of their usage make the usage of natural drugs topical again. Since immemorial people have tried to find century from the development of human kind and advanced civilizations, the healing properties of certain medicinal plants were identified, noted and conveyed to the successive generations. The continuous and perpetual people’s interest in medicinal plants has brought about today’s modern and sophisticated fashion of their processing and usage. The pharmacological evaluation of drugs from plants is a longtime method for the identification of lead compounds which may cause the event of novel and safe medicinal agents. Herbal medicines, because of the major remedy in the traditional medical system, are utilized in practice for thousands of years and have made an excellent contribution to take care of human health. An outbreak of

coronaviruses (COVID-19) has been discovered firstly in natural reservoir *i.e.* host and bats.^[1-4] Coronavirus are the large family of viruses that causes common cold to more severe respiratory syndrome, or SARS and can lead to death. This virus is a main threat to public health and is broadly distributed in the humans. The virus spread through person-to-person both in hospital and family.^[5,6] World Health Organization (WHO) has stated the coronavirus outbreak a global health emergency in March 2020. The study is still going on, but there is no specific treatment for coronavirus developed, but the symptoms can be treated. In this paper, we are going to discuss some plants that are effective against COVID-19.

REVIEW OF LITERATURE

In India, the references to the curative properties of some herbs in the Rig-Veda seem to be the earliest records of the use of plants in medicines. The medicinal plants are extensively utilized throughout the world system of medicine into two different systems in which one is the traditional system of medicine and the another one is the modern system of medicine. The traditional system of drugs mainly functions through the 2 distinct streams^[1] Local or folk or tribal stream and,^[2] Codified and

arranged Indian system of medicines like Ayurveda Siddha and Unanni etc. over the centuries, the use of medicinal herbs has become an important part of daily life despite the progress in modern and pharmaceutical research. Approximately 3000 plants species are known to have medicinal properties in Indian.^[5] The Rigveda (3700 B.C.), mentions that about the use of medicinal plants. Our traditional system of medicines, viz, Ayurveda, Yunani, Siddha and Homeopathy etc. use herbs for treatment. It is estimated that 40% of the world populations directly depends on plants-based medicine for their wellbeing. Plants have been responsible for the predominant ingredients of medicines in maximum medical traditional. There is no reliable figure for the total number of medical plants on earth and the number of the species used medicinally includes: 35,000-70,000 or 53,000 worldwide; 10,000-11,250 in China; 7500 in India.^[7]

According to fossil records, the human use of plants as medicines could also be traced back to a minimum of 60,000 years. It is highly possible that once seeking food, early humans often consumed poisonous plants, which led to vomiting, diarrhea or other toxic response maybe even death. However, during this way, early humans were ready to develop knowledge about edible materials and natural medicines. Subsequently, humans invented fire, learned the way to make alcohol, developed religions and made technological breakthroughs, and that they learned the way to develop new drugs. World Health Organization (WHO) has defined medicinal plants that contain properties or compound which will be used for therapeutic purposes or people who synthesize metabolites to supply useful drugs (WHO 2008). Medicinal plants constitute a crucial component of flora and are cosmopolitan in INDIA. Exploring plants for the presence of bioactive molecules as a template for new antibacterial substances is a much-needed exercise, given the continuing and developing problems of bacterial against currently used antibiotics, and multidrug resistant bacteria. Certain natural products obtained from plant are reported to alter or modify bacterial resistance. Plants produced secondary metabolites as a part of their defense strategy against bacteria. Secondary metabolites have more potential antimicrobial activity as compared to synthetic drugs. Plants have the ability to synthesize secondary metabolites as aromatic substances, mostly phenols, tannins, terpenoids and polypeptides. The phytochemicals can be divided into the following major categories: 1) Phenolic and polyphenols 2) Terpenoids 3) Alkaloids 4) Lectins and polypeptides. The Indian holy books Vedas mention treatment with plants used, which are abundant in that country. Undoubtedly, the plant kingdom still has wide variety of being regularly for their possible bioactivity. There are some other significant advantages claimed for therapeutically usages of medicinal plants in various diseases are their safety moreover being economical, effective and easy availability. Therefore, we expect rapid actions in this direction to combat with COVID-19 also with aid of

better screening methods from plants and other natural sources. Some of these plants are discussed below.

1) GARLIC (*Allium sativum*)

The scientific name of garlic is *Allium sativum*, in Hindi and Gujarat it is commonly called as Lasan, in Sanskrit it is called as arishta, lashuna and in English it is called garlic. Garlic bulbs are the medicinally important used part of Garlic. *Allium sativum* is among the oldest of all cultivated plants and has been used as a medicinal agent for thousands of years. It has multiple beneficial effects such as antimicrobial, antithrombotic, antiarthritic, and antitumor activity. Garlic is used in different traditions as prophylactic as well as a therapeutic medicinal plant. Garlic is used to aid respiration and digestion and also used to treat disease like leprosy and parasitic infestation.^[7] AVICENNA (1998), a well-known book,^[8] describes garlic as a useful treatment for arthritis, toothache, chronic cough, constipation, parasitic infestation disease. Garlic is useful in the reduction of a risk factor for cardiovascular diseases, reduction of cancer risk, antioxidant effect, antimicrobial effect and enhancement of detoxification of foreign compound and hepatoprotein.^[9] Garlic has found to contain a large amount of potent bioactive compounds with anticancer properties.^[10] Garlic has a variety of anti-tumor effects including tumor cell growth inhibition and chemo preventive effects. Anti-proliferative activity of ajoene was demonstrated against a panel of human tumor cell lines.^[11] more recently, garlic has been proven to be effective against a plethora of gram-positive, gram-negative and acid-fast bacteria like *salmonella*, *E. coli*^[12] and *helicobacter*.^[13] Different studies have shown that the extract was effective against a host of protozoa including *Candida albicans*, *Scedosporium prolificans*, *Tineapedis*.^[14] Due to increasing resistance to the synthetic pharmaceuticals, garlic was recommended for the treatment of giardiasis. Many fungi are sensitive to garlic including *Candida*,^[15] reduce the growth of the organism, inhibit the synthesis of lipids, proteins and nucleic acids, cytomegalovirus, herpes simplex virus 2,^[16] viral pneumonia and rotavirus.

2) TULSI (*Ocimum tenuiflorum*)

The scientific name of Tulsi is *Ocimum tenuiflorum*, in Hindi it is commonly called as tulsi, in Sanskrit it is called as Tulasi and in English it is called Holy basil. Leaves are medicinally important used part of Tulsi. *Ocimum tenuiflorum* is among the oldest of all cultivated plants and has been used as a medicinal agent for thousands of years. Tulsi is a perfumed shrub in the basil family of *lamiaceae* which is originated in the north central India and also grows native throughout the eastern world tropics,^[17] within Ayurveda, tulsi is also known as “Mother Medicine of Nature” and “The Queen of Herbs” and is admired as an “elixir of life” that is without equal for both its medicinal and spiritual properties.^[18] Tulsi protects against toxic chemical induced injury by increasing the body’s level of antioxidant molecules and enhancing the activity of

antioxidant enzymes. Tulsi also helps to prevent cancers caused by toxic compounds by reducing DNA damage.^[19] Tulsi also improve lipid profiles, prevent weight gain, hyperglycemia, hyperinsulinemia, hypertriglyceridemia and insulin resistance.^[20] Tulsi has anti-bacterial, anti-viral, anti-fungal activity. Tulsi's broad spectrum activity, which includes activity against *Streptococcus mutans*, which is responsible for tooth decay, further suggests that it can be used as herbal mouth wash for treating bad breath, gum disease and mouth ulcers.^[21] Tulsi's unique combination of antibacterial antioxidant anti-inflammatory gestic activities also makes it useful in wound healing.^[22] Tulsi aqueous leaf extract intramammary infusion has also shown promising effects on improving the immune response.^[23] Various clinical trials reported on the metabolic conditions on type 2 diabetes or metabolic syndrome with measures of blood sugar, lipids and sign yet only one study reported on the clinical symptoms associated with type 2 diabetes such as polydipsia, sweating, fatigue, burning feet, headache and obesity.^[24] Some studies on uric acid changes in participants with gouty arthritis also.^[25]

3) CAPSICUM (*Capsicum annuum*)

The scientific name of capsicum is *Capsicum annuum*, in Hindi it is commonly called as Shimla mirch, in Sanskrit it is called as mahaamareechikaa and ghantaamareecha and in English it is called chilli pepper, green pepper. Fruits are medicinally important used part of capsicum. The fruit of most species of Capsicum having capsaicin (methyl-n-vanillylnonenamide), is a lipophilic synthetic having strong burning impact (pungency) within the mouth of the rare diner. It has metabolic syndrome, a coexisting of high blood glucose, obesity and hypertension is an important risk factor for cardiovascular disease occurrence and mortality.^[26] The use of capsicum fruit as a food additive has been used for the treatment of cough, toothache, parasitic infections, wound healing and also used as antiseptic, counterirritant, appetite stimulator, antioxidant and immune modulator.^[27] Other effects such as antibacterial and anticancer are also related to chilies.^[28] Red pepper as a drug is given in atonic dyspepsia and flatulence due to increasing the motility in the gastric antrum, proximal jejunum and colon.^[29] It can also increase parietal, pepsin a bile acid secretion.^[30] Chilies are known to protect against gastrointestinal ailment, loss of appetite, gastroesophageal reflux disease, and gastric ulcer.^[31] Moreover, the leaves of its plant have antioxidant activity. The medicinal effects of chilies are related to different constituents such as capsaicin, fixed oil, thiamine, protein and ascorbic acid.^[32]

4) ASHAWAGANDHA (*Withania somnifera*)

The scientific name of ashwagandha is *Withania somnifera*, in Hindi it is commonly called as ashgandha, ashwagandha, rashbhari, in Sanskrit it is called as amukkura, ashvagandha, ashvakandika and in English it is called ashwagandha. Berry and roots are medicinally

important used part of ashwagandha. The root of Asvagandha is engaged within the sort of powder to manage utilization, immoderate emaciation, asbestosis, rheumatic ailments, insomnia, and cardiac diseases, wound thanks to an accident, suppression of urine, and for conception in sterility. In India it's distributed within the sub-Himalayan tracts, ascending upto 1000 m. It is found in Himachal Pradesh, Punjab and throughout the drier parts of India. This species is globally distributed from Africa to Sri Lanka. Within India, it is scattered in the sub-Himalayan tracts, mount upto an altitude of 1000 m. It is found throughout the drier parts of India. Ashawagandha is a very revered herb of the Indian Ayurvedic system of medicine as a Rasayana. It is commonly cited to as "Indian Winter Cherry" or "Indian Ginseng". It is one of the most important herbs of Ayurveda used as millennia as a Rasayana for its wide-ranging health benefits. These sorts of remedies are given to young children as tonics, and also are taken by the center aged and elderly to extend longevity. It is used for various sorts of disease processes and particularly as a nervine tonic. It has a cognition promoting effect and was useful in children with memory deficit and in adulthood people loss of memory. It has tranquilized effect and improves energy levels and mitochondrial health. It improves the function of the genital system promoting a healthy sexual and reproductive balance. The biological active chemical constituents of *withania somnifera* include alkaloids, steroidal lactones and saponins.^[33] Ayurveda, the traditional system of medicine practiced in India can be traced back to 6000 BC.^[34] It is commonly used in children, debily from old age, rheumatism, constipation, insomnia, nervous breakdown, goiter etc.^[35] It also helps in leucorrhoea, boils, pimples, flatulent colic, worms and piles.^[36] Use of *withania somnifera* in the prevention and treatment of many stress included diseases like arteriosclerosis, premature aging, arthritis, hypertension and malignancy. It acts as an anti-tumor, anti-cancer, also improves the white blood count and function, which are depleted in the chemotherapeutic treatment of cancer. Ashwagandha is used for the treatment of fibroids tumors of the uterus showed reduction of uterine bleeding and also the disappearance of fibroids after extended treatment.^[37] It may also be useful in protecting the neural injury in the Parkinson's disease.^[38]

ALOE VERA (*Aloe barbedenis comman*)

The scientific name of aloe vera is *Aloe barbedenis comman*, it is commonly called as Ghrit Kumari. Leaves are medicinally important used part of aloe vera. Aloe vera is the oldest medicinal plant used ever known and the most applied medicinal plant. It contains a large range of vitamins. The Egyptians entitle aloe "The Plant of Immortality".^[39] It has 3 layers in their leaf which is used as the medicinal part i.e., i) Aloe rind: the protective, green outer skin bears no significant nutritional value. ii) Aloe latex: the bitter, yellowish like fluid which has a bad odor and flows in between the leaf rind and the inner fleshy part of the leaf, it contains


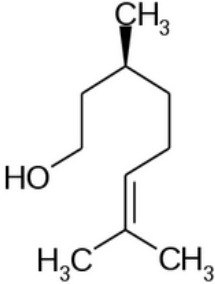
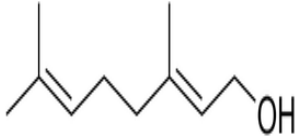
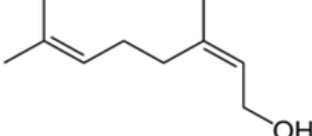

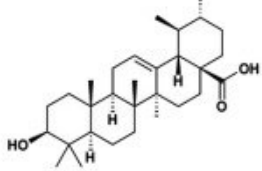
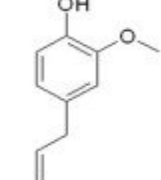
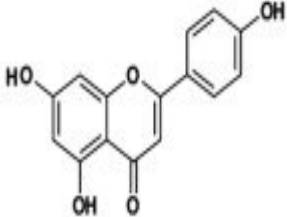

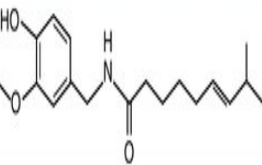
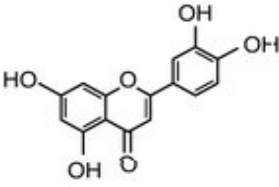
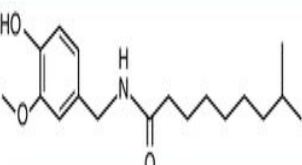

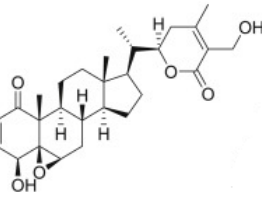
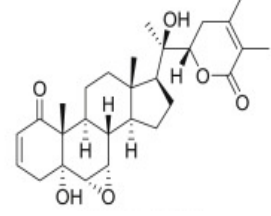
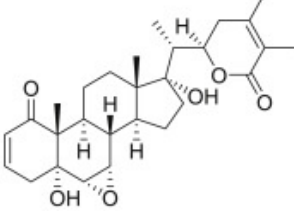

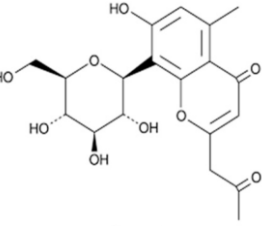
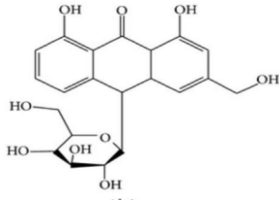
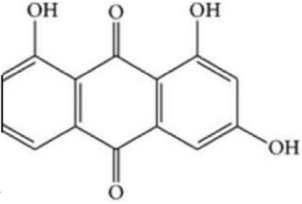
anthraquinones and glycorides. iii) Inner leaf juice: the clear, inner, fleshy, portion of the leaf that is packed with nutrients and very healthy for internal and external consumption.^[40] Aloe vera contains 75 potentially active constituents: a vitamin, enzymes, minerals, sugars, lignin, saponos, salicylic acids and amino acids^[41] Aloe vera contains vitamins including vitamin B12, folic acid and choline which acts as a antioxidant. Sugars like glycoprotein with anti-allergic properties called allergen and novel anti-inflammatory compounds; C-glycosyl chromone has been isolated from aloe vera gel.^[42] Aloin and emodin acts as antibacterial and antivirals. Fatty acids like cholesterol, campesterol, beta-sisosterol, lupeol, all have anti-inflammatory action but lupeol additionally possesses antiseptic and analgesic property. Hormones like auxin and gibberlin helps in wound healing and anti-inflammatory action. Aloe vera also provides 20 of 22 human required amino acids and 7 of the essential amino acids. Salicylic has anti-bacterial and anti-inflammatory activity. Saponin that is soapy substance form about 3% of the gel and have cleansing and has anti-septic property.

Some plants which exhibit properties to act against Covid-19 are described in table 1. *Allium sativum* shows anti-bacterial activity, antiviral (ACE2 and PDB6LU7 proteins protein of SARS-CoV-2) activity. *Withania somnifera* also shows activity against enzyme for proteins protease (Mpro) of SARS-CoV-2, anti-malarial drug, anti-viral activities, antibacterial, antifungal. *Aloe barbedenis comman* having anti-viral anti-malarial activities, treatment of covid19 in the early stage, coronavirus SARS-CoV-1, Haemorrhagic Viral Rhobdavirus Septicaemia, Herpes simplex virus type 1, Herpes simplex virus type 2, Varicella-Zoster virus, human immunodeficiency virus, Influenza virus, poliovirus, Cytomegalovirus, Human papillomavirus shown in table 1. Table 2 includes molecular structures of the compounds extracted from various Indian herbal plants like *Allium sativum*, *Ocimum Tenuiflorum*, *Capsicum annum*, *Withania somnifera* and *Aloe barbedenis comman* plants.

Table 1: Traditionally used medicinal plants with their medicinal part used, major bioactive compounds and also having antimicrobial activity, antiviral activities.

S.no	Scientific name	Common name	Medicinal plant part	Active compounds	Bacteria	Active against virus, fungal and bacteria	Ref.
1	<i>Allium sativum</i>	Lasan, Garlic	Garlic bulbs	Allicin, Citronellol, Geraniol	<i>S. aureus</i> (Gram positive bacteria) <i>E. coli</i> (gram negative bacteria)	Anti-bacterial activity, Antivirus (ACE2 and PDB6LU7 proteins protein of SARS-CoV-2)	[42]
2	<i>Ocimum tenuiflorum</i>	Tulsi	s	Urasonic acid, Rosmarin acid, Eugenol, Apigenin	<i>S. aureus</i> , <i>E. coli</i> , <i>P. aeruginosa</i>	Antimicrobial, anti-fungal properties, anti-influenza activity	[18]
3	<i>Capsicum annum</i>	Shimla mirch	Fruits	Capsaicin, Luteolin, Dihydrocapsaicin	Erythroycin-resitant, cell-invasive group A <i>streptococci</i>	Anti-bacterial	[27]
4	<i>Withaniasomnifera</i>	Ashwagandha	Berry, roots	Alkaloids, saponins, Withaferin A, Withanolide, Withanone	pathogenic bacteria	Active against enzyme for proteins protease (Mpro) of SARS-CoV-2, Anti-malarial drug, anti-viral activities, Antibacterial, antifungal	[43]
5	<i>Aloe barbedeniscomman</i>	Aloe vera	Leaves	Aloesin, Aloin, Emodin, Salicylic acid, Cinnamonic acid	<i>S. aureus</i> , <i>pyogenes</i> , <i>Salmonella paratyphi</i>	Active against covid19 in the early stage, coronavirus SARS-CoV-1, Herpes simplex virus type 1, Herpes simplex virus type 2, Influenza virus, poliovirus.	[44, 45]

Table 2. Molecular structures of the compounds extracted from Indian herbal plants.

Plant Name	Figure	Compound-1	Compound-2	Compound-3
Garlic (<i>Allium sativum</i>)		 <i>Citronellol</i>	 <i>Geraniol</i>	 <i>Nerol (trans-Geraniol)</i>
Tulsi (<i>Ocimum tenuiflorum</i>)		 <i>Urasonic Acid</i>	 <i>Eugenol</i>	 <i>Apigenin</i>
Shimla-mirch (<i>Capsicum annum</i>)		 <i>Capsaicin</i>	 <i>Luteolin</i>	 <i>Dihydrocapsaicin</i>
Ashwagandhha (<i>Withania-somnifera</i>)		 <i>Withaferin A</i>	 <i>Withanolide</i>	 <i>Withanone</i>
Aloe-Vera (<i>Aloe-barbedeniscomman</i>)		 <i>Aloesin</i>	 <i>Aloin</i>	 <i>Emodin</i>

Garlic (*Allium sativum*) is a powerful antibiotic and having antimicrobial effects, such as killing bacteria, viruses, and fungi. Tulsi (*Ocimum tenuiflorum*) is one of the most religious and medicinal plant in India and grown throughout the country from Andaman and Nicobar island to the Himalayas. The fruit of the Shimla

Mirch (*Capsicum annum*) has various properties like antiseptic, diaphoretic, digestive and used in the treatment of the cold stage of fevers. Ashwagandhha (*Withania somnifera*) is known as Indian winter cherry. Aloe Vera (*Aloe barbedenis comman*) is a well-known medicinal plant with sharp pointed, lanced shaped and

edged leaves having its origin in African content. COVID-2019 is a serious infectious disease. COVID-2019 is known to cause respiratory infections ranging from the common cold to more severe diseases and even death. Some antiviral drug namely Remdesivir was reported as a promising drug against wide selection of RNA viruses. Holshue *et al.* reported that patient infected with COVID-2019, when treated with remdesivir antiviral drug resulted in achieving good results.^[46,47] Clinical trials of another drug namely Remdesivir is also undergoing, but the final efficacy of the drug is unclear. But, the study of these antiviral drugs is still unclear. The plants mentioned in this paper may be useful for the treatment of COVID-19.

CONCLUSION

In the next few decades, herbal medicine may become a new era of the medical system for the management of human diseases. About 80% of world populations rely on traditional medicine for primary health care. There has been a resurgence of interest in the investigation of medicinal plants as a source of potential herbal medicine. There is a necessity to advance research for the expansion and characterization of new natural drugs. Some of the studies show that ashwagandha is the potential inhibitors of COVID-19 protease. The inhibition potentials of all these plant extracts are found to be larger than those of chloroquine and hydroxychloroquine. These two anti-malarial drug compounds are already reported to inhibit COVID-19 protease in vitro. Due to inherent toxicity and side-effects, however, they are not approved by most of the countries. Therefore, these findings become very interesting towards the development of herbal medicines having no apparent side effects. We expect prompt actions in this direction to combat with COVID-19 with aid of better screening methods from plants and other natural sources.^[48]

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Conflicts of Interest

The authors declare no conflict of interest.

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