

Traditional System of Medicine and Management of the COVID-19 Pandemic in India

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ABSTRACT The traditional system of medication, including Ayurveda, has been accepted widely for treatment of diseases in India, and hence it is being utilised by the people for the management of the COVID-19 pandemic as well. In this backdrop, the traditional system of medicine in India was studied and examined for managing the COVID-19 pandemic. People in India mainly rely upon *Ocimum tenuiflorum*, *Tinospora sinensis*, *Zinziber officinale*, *Cinnamomum zeylanicum*, *Curcuma domestica*, *Phyllanthus emblica*, *Syzygium aromaticum*, *Piper nigrum*, *Citrus medica*, and *Trachyspermum ammi* to manage COVID-19 either by using them alone or as a decoction of more than one species. Apart from herbal formulations, yoga, steam inhalation, lifestyle changes and disinfection of the environment are the cause of concern in managing COVID-19. There is no scientific evidence and claim that the traditional system of medication can cure the COVID-19 disease, however, it may help to improve the immunity and disinfect the home environment, which may finally help to fight against the pandemic.

INTRODUCTION

The world has seldom faced a pandemic like SARS-CoV-2/Novel Coronavirus-19 (COVID-19) in the era when medical science has accomplished high standards and advanced technologies. Worldwide, a total of 3,494,758 people have died due to the COVID-19 outbreak until May 27, 2021 (WHO 2021), and of these 318,895 human deaths were in India (MyGov 2021), which is 9.12 percent of the total global deaths attributed to the COVID-19 pandemic. Despite inadequate medicines, relatively poor modern healthcare infrastructure, and mammoth population pressures, the records of the World Health Organisation (WHO 2021) and the Government of India (MyGov 2021) indicate that the human fatality rate in India remains lower (1.16%) than the world fatality rate (2.07%) as of May 27, 2021.

Since there is no effective medicine so far discovered for the treatment of COVID-19, people have been seeking the possible sources of remedy in various therapeutic systems (Kala 2020a; Zhao et al. 2020). The traditional system of medicines in India has been applied to healthcare for a long period of time, which has been enriched with the advent of new diseases (Kala 2005; Wujastyk and Smith 2008). Plants being the major ingredients in these traditional medical systems, there have been continuous experiments

on such an important bio-resource for healthcare and also to deal with the new diseases (Patwardhan et al. 2005; Khan et al. 2021). At present, in view of fighting against COVID-19 as well, a large number of people in India have been using various traditional medication practices, including Ayurveda, yoga, Sowa-Rigpa and Unani (Kala 2020a; Ministry of AYUSH 2020a; Tilly et al. 2020).

The vaccination drive began in India on January 16, 2021, and by May 27, 2021 a total of 205,720,660 vaccination doses have been injected (MyGov 2021). However, it seems to be quite low in comparison to its overall population, which is over 1,392 million (Worldometer 2021). To vaccinate such a huge population is expected to consume considerable time and till then a large number of population will remain in very high-risk zone. Therefore, the guidelines of the Ministry of AYUSH are based on the traditional therapeutic systems in India, which appear to be quite relevant for managing the COVID-19 pandemic (Ministry of AYUSH 2020a). As per the traditional system of medicine like Ayurveda, the COVID-19 being a pandemic vitiates air, water and land, which need to be managed accordingly (Sulaiman et al. 2021). At the same time, in the era of scientifically validated modern medical systems, there are apprehensions on the efficacy and safety of traditional therapeutic systems with respect to their

use for managing the COVID-19 pandemic. In this context, the present study attempts to review the existing information on the utility of traditional systems of medicines, including medicinal plants for management of the COVID-19 pandemic in India. Besides, an attempt is made to examine the traditional medicinal system in a holistic way to manage COVID-19 and also with respect to the modern scientific outlooks.

METHODOLOGY

An extensive literature survey was carried out for compilation of information on traditional medicinal knowledge and use of medicinal plant species in India for the management of the COVID-19 pandemic. The literature, searched from different sources, includes scientific journals, technical reports, websites, and newspaper reports. The academic literature databases such as EBSCO, JSTOR, and Science Direct were consulted. The relevant materials were screened out of the voluminous results searched using the Internet search engines of mainly Google and Google Scholar. Specific search terms such as 'traditional medicine in India and COVID-19', 'medicinal plants in Ayurveda and COVID-19', 'traditional medicine in India and coronavirus pandemic' were explored. A large set of information was collected through secondary sources.

The guidelines issued by the Ministry of AYUSH of the Government of India were also studied. Apart from the secondary sources, the online interviews and questionnaire surveys through WhatsApp and emails were conducted among the common people and also among the experts, including practitioners of traditional systems of medicines in India. Since there was a lockdown in various states of India, it was not feasible to have traditional questionnaire surveys or personal interactions with the respondents. Through online surveys the information was compiled about the plants used for the management of COVID-19, plant parts used, the preferences of important medicinal plants, and the traditional knowledge and practices as used for management of COVID-19. Besides, the traditional medicinal knowledge was studied in the modern perspective through literature review.

RESULTS AND DISCUSSION

Traditional Knowledge and COVID-19 Management

In India, the traditional system of medication has been ingrained in the social and cultural systems of the human societies. Apart from the experts of treating diseases, for instance the practitioners of Ayurveda, Unani, Siddha and Sowa-Rigpa, there are common people in the society who occupy a fair amount of knowledge on treatment of diseases through generations. There are diverse practices and approaches of using resources and knowledge systems for managing diseases. Based on the past experiences of handling diseases, the new formulations and practices have evolved for possible treatment of new diseases. At present, mainly three traditional approaches are practiced in India to manage the COVID-19 pandemic. Being an infectious, viral borne disease that affects the respiratory systems, the traditional therapeutic practices to fight COVID-19 largely deal with medication related to viral diseases, human respiratory systems, and also to improve the body's immunity system. Besides, people perform some rituals to disinfect the environs, as it is believed that the viruses may remain active for some time in the home and outside environs.

Use of Ethno-medicines

The practitioners of traditional systems of therapies, including *vaidyas* (the practitioners of Ayurveda), prescribe three important things for treatment of diseases, that is, herbal formulations, balanced diets, and proper lifestyle following daily and seasonal routines along with good moral conduct (Kala 2005, 2020b). *Vaidyas* believe that any disorder in human body is a result of imbalance in '*vata*' (air), '*pitta*' (phlegm) and '*kaph*' (cough). Therefore, the practitioners of traditional therapies have been managing COVID-19 by recommending homemade herbal formulations along with advise for balanced diets, daily routine and seasonal routine (Ministry of AYUSH 2020a; Panda et al. 2020). Since the herbal formulation was prepared on the spot after checking the condition of patients, the constitution of herbal formulation might differ by patients based upon the

current health status of patients and imbalance in air, phlegm and cough of the respective patient. The potency of herbal formulation may be increased or decreased based upon the needs of the patient and the duration of the treatment.

Inhalation of steam is a common traditional practice in India for the treatment of cough, cold, congestion in nose and throat, and infection of bacteria and virus in the nose, throat and lungs (Sanders 2007; Chandran et al. 2018). Therefore, the steam inhalation is prescribed alone or with *Trachyspermum ammi* and *Mentha arvensis* to the COVID-19 patients, as well (Table 1). During the present investigation, over ninety percent of respondents admitted that they had used steam inhalation for preventing COVID-19. Consuming light and healthy food, and taking adequate rest or sleep is also recommended. Traditionally, frequent consumption of sweet food items is discouraged. Besides, touching eyes, nose and mouth unnecessarily is discouraged. Yoga, an age-old practice in India, being engrained with healthy living, is recommended to be practiced daily.

Table 1: Traditional practices as adopted in India for management of COVID-19

S. No.	Traditional practices and beliefs
1	Inhalation of steam alone or with <i>Trachyspermum ammi</i> and <i>Mentha arvensis</i>
2	Eat light healthy food and take adequate sleep
3	Avoid touching eyes, nose and mouth unnecessarily
4	Controlling consumption of sweet food items
5	Practice yoga, especially pranayama
6	Get some sun in the morning hours
7	Nasal irrigation by water or Jal-Neti
8	Nasal rinsing by couple of drops of <i>Citrus medica</i> and <i>Zingiber officinale</i>

The use of plants is the major aspect of traditional systems of medication in India, including Ayurveda, Unani, Sowa-Rigpa and Siddha (Kala 2005, 2017). During the present study, a total of 54 medicinal plant species have been documented as those that are used for management of COVID-19, including immunity boosters and disinfecting the home and environment in India (Table 2). Of the total species, 33 species are used for management of the COVID-19 and 21 species are used as immunity booster. A total 12 species such as *Allium sativum*, *Azadirachta indica*, *Bacopa*

monnieri, *Curcuma domestica*, *Glycyrrhiza glabra*, *Moringa oleifera*, *Ocimum tenuiflorum*, *Phyllanthus emblica*, *Syzygium aromaticum*, *Tinospora sinensis*, *Withania somnifera* and *Zingiber officinale* are used for the purpose of both the COVID-19 management and immunity booster.

Each plant has specific medicinal properties such that a specific species is used for treatment of a particular disease. Some species are used for treatment of fever, while others are used for maintaining immunity or making the virus inactive. Accordingly, different plant species having different medicinal properties are mixed to form the herbal formulation to deal with diverse impacts of any disease, including COVID-19. Fever, dry cough and tiredness are the most common symptoms of COVID-19. As per the multiple symptoms of a disease, plant species as per their curative properties are mixed up in different proportions to form a formulation, which may help to deal with all the symptoms in one go.

Plants and Practices as Immunity Booster

Traditionally, a diet high in fruits and vegetables is considered healthy and helps to strengthen the immune system. Proper combination of balanced healthy diets, lifestyle and yogic exercises are known to maintain and enhance the human immunity systems. Besides, there are many herbal formulations, which help to revitalise the immune system. Herbal teas, decoction, and powders of many plant species are recommended to enhance the immunity (Sultan et al. 2014; Sarkar 2015; Kala 2021).

The term '*kadha*' literally stands for decoction, and it is a quite popular traditional household medicine, which is comprised of an assortment of herbs and spices boiled in water to finally extract the valuable phytochemical compounds from the medicinal plants (Gautam et al. 2020). There are varieties of *kadha* as prepared by using single plant species such as *Ocimum tenuiflorum* and *Zingiber officinale* or a mixture of *Ocimum tenuiflorum*, *Zingiber officinale* and *Mentha arvensis* or mixture of *Azadirachta indica*, *Mentha arvensis*, *Curcuma domestica*, etc. or as a mixture of two or more than two species. It is used in COVID-19 for both its management and as an immunity booster (Ministry of AYUSH 2020a).

Table 2: Important plants used in management of COVID-19 in traditional systems of medicines in India

S. No.	Species	Vernacular name	Plant part used	COVID management	Immunity booster	Environ- Environ- fection
1	<i>Aegle marmelos</i> (L.) Correa	Bel	Wood			✓
2	<i>Allium sativum</i> L.	Lahsun	Bulb	✓	✓	
3	<i>Aloe vera</i> (L.) Burm. f.	Ghrithkumari	Leaf	✓		
4	<i>Andrographis paniculata</i> (Burm. f.) Nees	Kalmegh	Whole herb	✓		
5	<i>Azadirachta indica</i> A.H.L. Juss.	Neem	Leaf, Wood	✓	✓	✓
6	<i>Bacopa monnieri</i> (L.) Penn.	Brahmi	Whole plant	✓	✓	✓
7	<i>Boerhavia diffusa</i> L.	Punarnava	Whole plant	✓		
8	<i>Butea monosperma</i> (Lam.) Taub.	Palash	Wood			✓
9	<i>Carica papaya</i> L.	Papita	Fruit	✓		
10	<i>Cinnamomum camphora</i> (L.) J. Presl	Camphor	Oil			✓
11	<i>Cinnamomum zeylanicum</i> Nees	Dalchini	Leaf, bark	✓		
12	<i>Citrus</i> sp.	Kagji Neebu	Juice	✓		
13	<i>Cocos nucifera</i> L.	Nariyal	Oil	✓		✓ (Fruit)
14	<i>Commiphora wightii</i> (Arn.) Bhandari	Guggulu	Gum			
15	<i>Coriander sativum</i> L.	Dhaniya	Fruit	✓		
16	<i>Cuminum cyminum</i> L.	Jeera	Fruit	✓		
17	<i>Curcuma domestica</i> Valetton	Haldi	Rhizome	✓	✓	
18	<i>Elettaria cardamomum</i> (L.) Maton	Ilaychi	Fruit			✓
19	<i>Eucalyptus</i> sp	Eucalyptus	Oil	✓		
20	<i>Ficus racemosa</i> L.	Gular	Bark			✓
21	<i>Ficus religiosa</i> L.	Peepal	Stem, bark			✓
22	<i>Fritillaria roylei</i> Hk.	Kakoli	Bulb		✓	
23	<i>Glycyrrhiza glabra</i> L.	Mulethi	Stem	✓	✓	✓
24	<i>Habenaria edgeworthii</i> Hook. f. ex Collet	Vridhhi	Tuber		✓	
25	<i>Habenaria intermedia</i> D. Don	Riddhi	Tuber		✓	
26	<i>Hordeum vulgare</i> L.	Jau	Seed			✓
27	<i>Justicia adhatoda</i> L.	Adusa, Vasaka	Leaf	✓		
28	<i>Lilium polyphyllum</i> D. Don ex Ro	Chhirkakoli	Bulb		✓	
29	<i>Malaxis acuminata</i> D. Don	Jeevak	Bulb		✓	
30	<i>Malaxis muscifera</i> (Lindley) Kuntze	Rishbhak	Bulb		✓	
31	<i>Mangifera indica</i> L.	Aam	Stem, Leaf			✓
32	<i>Mentha arvensis</i> L.	Pudina	Leaf	✓		
33	<i>Moringa oleifera</i> Lam.	Sahjan	Leaf, pods	✓	✓	
34	<i>Ocimum tenuiflorum</i> L.	Tulsi	Leaf	✓	✓	
35	<i>Oryza sativa</i> L.	Rice	Seeds			✓
36	<i>Phyllanthus emblica</i> L.	Awala	Fruit	✓	✓	
37	<i>Piper longum</i> L.	Long, Pipli	Fruit			✓
38	<i>Piper nigrum</i> L.	Kali mircha	Fruit	✓		
39	<i>Polygonatum cirrhifolium</i> Royle	Meda	Root		✓	
40	<i>Polygonatum verticillatum</i> Allioni.	Mahameda	Root		✓	
41	<i>Punica granatum</i> L.	Anar	Fruit	✓		
42	<i>Santalum album</i> L.	Chandan	Stem			✓
43	<i>Saussurea costus</i> (Falc.) Lipsch	Kut	Root	✓		
44	<i>Sesamum indicum</i> L.	Til	Oil	✓		✓
45	<i>Swertia chirayita</i> (Roxb.) Buch.-Ham. ex Cl.	Chirata	Whole plant	✓		
46	<i>Syzygium aromaticum</i> (L.) Merr. & L.M. Perry	Lawang	Flower bud	✓	✓	
47	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Haida	Fruit	✓		
48	<i>Terminalia chebula</i> Retz.	Baida, Haritaki	Fruit	✓		
49	<i>Tinospora sinensis</i> (Lour.) Merr. Syn <i>T. Cordifolia</i> (Willd.) Miers	Giloy	Stem	✓	✓	
50	<i>Trachyspermum ammi</i> (L.) Sprague	Ajwain	Seeds	✓		
51	<i>Tribulus terrestris</i> L.	Gokhuru	Seed/ fruit		✓	
52	<i>Vitis vinifera</i> L.	Munakka	Fruit	✓		
53	<i>Withania somnifera</i> (L.) Dunal	Ashwagandha	Root	✓	✓	✓
54	<i>Zinziber officinale</i> Roscoe	Adrak, Shunthi	Rhizome	✓	✓	

Traditionally, a large number of plant species are recommended to enhance and maintain the human immunity (Kala 2003, 2021; Dhyani et al. 2010; Singh et al. 2021). The important plant species, which have frequent mention in traditional herbal formulations for enhancing immunity are *Allium sativum*, *Bacopa monnieri*, *Curcuma domestica*, *Glycyrrhiza glabra*, *Fritillaria roylei*, *Habenaria edgeworthii*, *Habenaria intermedia*, *Lilium polyphyllum*, *Malaxis acuminata*, *Malaxis muscifera*, *Moringa oleifera*, *Ocimum tenuiflorum*, *Phyllanthus emblica*, *Polygonatum verticillatum*, *Polygonatum cirrhifolium*, *Syzygium aromaticum*, *Tinospora sinensis*, *Tribulus terrestris*, *Withania somnifera* and *Zinziber officinale*.

On some occasions, the use of a plant for treatment of diseases depends on its availability. Some of the plant species have localised distribution and others are categorised as rare and threatened species, and hence there is ban on their collection from the wild. Some of these medicinal plant species are both endemic and threatened. For instance, the well-known Ayurvedic formula *Ash-tavarga* that was developed for rejuvenating the weak human body, comprises of eight high altitude Himalayan herbs (Dhyani et al. 2010; Balkrishna et al. 2012; Kant et al. 2012). All these herbs, such as *Fritillaria roylei*, *Habenaria edgeworthii*, *Habenaria intermedia*, *Lilium polyphyllum*, *Malaxis acuminata*, *Malaxis muscifera*, *Polygonatum verticillatum* and *Polygonatum cirrhifolium*, are considered to be rare and threatened categories (Kala 2010; Dhyani et al. 2010). Moreover, it is not an easy task to cultivate these species because of their specific ecological requirements. On the other hand, some of the important species used to enhance immunity have wide distribution range and are raised in farmlands and even home gardens. Such species (namely, *Syzygium aromaticum*, *Zingiber officinale* and *Curcuma domestica*) remain available for the purpose of use, as and when required, as they are also used as spice in regular diets.

There are some herbal formulations, which are recommended for consumption during the specific seasons. For instance, barley water is prescribed to drink during summer season for enhancing the immunity, as it is loaded with nutrients. Herbal tea made with milk, ginger and cardamom helps to revitalise the health. Turmeric milk is another popular traditional drink in India for

enhancing immunity. Though, there are many herbal formulations for enhancing or revitalising the human immune system, it is important that before using any herbal formulation one must consult an expert since there are human subject variabilities and one may develop allergies to certain formulations.

Disinfecting Environs

Since the Vedic era, Hindus have been performing a ritual called as '*hawan*' for invoking powerful energies of the divine and purifying the surrounding environment. In *hawan*, a number of herbs, aromatic oils and cow ghee are offered in a consecrated fire. Besides the number of social and cultural uses, the *hawan* is considered an important ritual to fight against infectious diseases, especially those spread through contaminated environment. By the virtue of burning many medicinal and aromatic plants to ashes, they release a number of volatile oils into the environment, which help to eradicate viruses and bacteria from both environment and human body (Bansal et al. 2015). The vapours of aromatic oils enter into the body through the nose and mouth help to remove the unwanted microbes.

The transmission of the COVID-19 virus is reported by means of direct contact with an infected person and indirect contact with surfaces in the immediate environment. The virus remains in the air for some period and it becomes a threatening factor for humans (WHO 2021), which spreads more in windy weather (Coskun et al. 2021). Besides, the COVID-19 virus spreads and transmits in the indoor air (Noorimotlagh et al. 2020). In view of its airborne transmission, the practice of *hawan* is recommended, which purifies the air and may help to eradicate the COVID-19 viruses. People in India, therefore, perform this ritual in anticipation of managing the COVID-19 pandemic.

A large number of plant species are used in *hawan*, of which over 51 plant species have been enlisted by Nautiyal et al. (2007). However, the *hawan* can be performed at a small scale by using relatively less number of plant species. In order to disinfect the environment from COVID-19, the major plant species, which may be used in *hawan* are *Aegle marmelos*, *Azadirachta indica*, *Butea monosperma*, *Cinna-*

momum camphora, *Cocus nucifera*, *Elettaria cardamomum*, *Ficus racemosa*, *Ficus religiosa*, *Glycyrrhiza glabra*, *Hordeum vulgare*, *Mangifera indica*, *Piper longum*, *Santalum album*, *Sesamum indicum*, and *Withania somnifera* (Table 2). The leaves of *Azadirachta indica* are frequently burned alone into the rooms for eradicating various types of microbes, including viruses.

Preferences of People for Medicinal Plant Species

Of the total species, as documented during the present study, there are preferences of local people for plant species to deal with the COVID-19 pandemic (Table 3). Majority of the respondents have shown their preference to *Ocimum tenuiflorum*, *Tinospora sinensis*, and *Zinziber officinale*, followed by *Cinnamomum zeylanicum*, *Curcuma domestica*, *Phyllanthus emblica*, *Syzygium aromaticum*, *Piper nigrum*, *Citrus medica*, and *Trachyspermum ammi* as the most important species to manage COVID-19 either by using them alone or as a decoction of more than one species. The practitioners of traditional medical systems on one hand relies more on *Tinospora sinensis*, as the most preferred species to manage COVID-19, whereas the common people in other hand were using *Zinziber officinale* and *Ocimum tenuiflorum*, besides *Tinospora sinensis*, due to the wide acceptability of the traditional knowledge associated with these species through generations and their relatively easy availability. A study conducted by Singh et al. (2021) reports that about ninety-four percent of people perceive spices as the important herbal medicines for the treatment of COVID-19 virus. A study

conducted elsewhere reports that about seventy percent people believe in herbal medicines for managing symptoms related to COVID-19 (Nguyen et al. 2021).

Traditional Therapy in Modern Perspective

There are case studies reporting treatment of COVID-19 by using traditional medical systems, including Chinese (Zhao et al. 2020), and Ayurveda (Girija and Sivan 2020; Mishra et al. 2021). A patient having high fever, severe body ache, and severe cough is reported to be treated by administering the Ayurvedic medical system, which includes Ayurvedic medicines, diet and regimen (Girija and Sivan 2020). This case study reflects that focussed Ayurvedic treatment may prevent the illness of a COVID-19 patient to deteriorate further. In another case study, a 55-year-old COVID-19 infected person having comorbidities was treated successfully within 9 days by administering Ayurvedic medicines, yoga, lifestyle modification and balanced diet (Mishra et al. 2021). This indicates that integrative therapy can be effective in managing the COVID-19 even when the infected person has multiple comorbidities.

Ayush Kwath, prepared by boiling essential spices and medicinal herbs such as leaves of *Ocimum tenuiflorum*, bark of *Cinnamomum zeylanicum*, dry powder of *Zingiber officinale* and dried unripe fruits of *Piper nigrum*, is one of the important immunity booster drinks (Ministry of AYUSH 2020b). It has antiviral, antioxidant, and anti-inflammatory properties, and hence it is considered to be effective in controlling viral infections like COVID-19 (Gautam et al. 2020). This formulation is recommended to be

Table 3: Common people preferences of important plants for management of COVID-19 in India

S. No.	Medicinal plants (Vernacular and Latin names)	Preferences of people (in %)
1	Tulsi, <i>Ocimum tenuiflorum</i> L.	78
2	Giloy, <i>Tinospora sinensis</i> (Lour.) Merr. Syn <i>T. cordifolia</i> (Willd.) Miers	76
3	Adrak, <i>Zinziber officinale</i> Roscoe	76
4	Dalchini, <i>Cinnamomum zeylanicum</i> Nees	65
5	Haldi, <i>Curcuma domestica</i> Valetton	63
6	Awala, <i>Phyllanthus emblica</i> L.	61
7	Lawang, <i>Syzygium aromaticum</i> (L.) Merr. & L.M. Perry	52
8	Kali mirch, <i>Piper nigrum</i> L.	52
9	Nimbu, <i>Citrus</i> sp.	50
10	Ajwain, <i>Trachyspermum ammi</i> (L.) Sprague	37

consumed regularly for strengthening the immune system in children and the elderly people.

Selected phytochemicals and micronutrients (vitamins and minerals) play a considerable role in protection against both viral infection and pathogenicity (Ayseli et al. 2020). Since every plant species contains many phytochemicals, an in-silico study reveals that of the major phytochemicals present in *Tinospora sinensis*, the berberine (Chowdhury 2020) and Tinocordiside (Shree et al. 2020) inhibit the viral infection, thus they can be used to regulate the viral replication (Chowdhury 2020). Furthermore, Withanoside V and somniferine in *Withania somnifera*, and Ursolic acid and Vice-nin in *Ocimum sanctum* are some of the potential phytochemicals, which can be used to check the spread of COVID-19 pandemic (Shree et al. 2020).

Cinnamic amides and ferulic acids in *Tribulus terrestris* (Song et al. 2014; Brahmbhatt 2020), diacetylcurcumin in *Curcuma longa* (Adem et al. 2020) and phyllaemblicin-B, Phyllaemblicin G7 and phyllaemblinol in *Phyllanthus emblica* (Wu et al. 2020) are known to inhibit the COVID-19 bindings with various proteins in the body and hence help to manage its spread. The fruits of *Phyllanthus emblica* are very rich in vitamin C content and thus help to boost immunity, as well (Patwardhan et al. 2020).

Since the COVID-19 virus enters the body through the nose and mouth, hence nasal and oral rinsing using saline and medicated water may reduce the viral load in the mouth and nasal cavities (Casale et al. 2020). Oral and nasal rinsing by herbal extracts and medicated water has been practiced traditionally in India. A couple of drops extracted from *Zingiber officinale* and *Citrus medica* are used to rinse the nasal passages. In-silico studies indicate that the phytochemical compounds in *Zingiber officinale* and *Citrus medica* reduce the viral load in nasal passages (Haridas et al. 2021). There is a need of continuous research and the traditional system of medicine still needs to be explored extensively in terms of scientific and evidence-based research. The clinical trials may be conducted for setting up efficacy and safety of traditional medicines.

Benefits of Traditional Therapeutic Knowledge

The COVID-19 virus mutates and develops many variants. The new variants appear to be

more transmissible or deadlier than the present COVID-19 virus (Rubin 2021). The efficacy of various vaccines, as developed at present to fight against the COVID-19, requires to be investigated and standardised for the occurrence of every new variant. However, the traditional system for management of COVID-19 with some modifications may be applied for all types of COVID-19 variants.

Steam inhalation therapy has been practiced in India from ancient times for treatment of cold, flu, cough, and sinus congestion, as this practice releases humidity directly into the sinuses and lungs. In order to manage the present pandemic, this practice has increased several folds, which is evident from the surge of various types of electric vaporisers and steam inhaler equipment into the market. The present pandemic has also renewed faith and interest in the traditional systems of medication, including Ayurveda in India, which is mainly a plant-based therapeutic system. The demand and sale of many Ayurvedic products manufactured for general healthcare and immunity booster have also increased (Awasthi 2021).

The traditional system of medication is less expansive in comparison to the modern medical system (Kala 2010, 2015). A sizeable population in India lives below the poverty line and they may not afford high expenses on the health care. Besides, the people living in the far-flung areas may not get timely support from the primary healthcare systems due to less accessibility. They may receive some relief from the traditional therapeutic system. Moreover, for developing countries like India, which support a huge human population, creating modern healthcare infrastructure for such a large population in the event of a pandemic that spreads all across the country may not be applied immediately to all types of patients having mild to serious symptoms. The medicinal plant species available in their immediate surroundings and the traditional knowledge interwoven with these plant species may help the needy and poor people to fight against the diseases, including COVID-19.

Policy and Guidelines on Use of Herbal Medicines

The Ministry of AYUSH in the Government of India being an apex body dealing with vari-

ous traditional systems of medicine in India, including Ayurveda, Yoga and Unani, has framed policy and guidelines for management of COVID-19. Accordingly, after extensive consultation with experts and AYUSH institutions, the national clinical management protocol based on Ayurveda and yoga for management of COVID-19 was prepared (Ministry of AYUSH 2020b). As discussed in the present study, the general prescriptions for managing COVID-19, such as gargle with warm water alone or warm water added with a small amount of turmeric powder or Triphala (a powder made up of fruits of *Phyllanthus emblica*, *Terminalia chebula* and *Terminalia bellirica*), nasal application of medicated oil, steam inhalation, yoga or moderate physical exercises, and dietary measures are recommended in this protocol. Besides, three categories of patients such as prophylactic, asymptomatic COVID-19 positive and mild COVID-19 positive are made on the basis of clinical severity for the management of COVID-19 pandemic. The aqueous extract of *Tinospora sinensis* or its powder is recommended to all three categories of patients. For prophylactic care the aqueous extract of *Withania somnifera* or its powder is recommended along with 10 grams of chyawanaprasha (herbal health supplement) once in a day. For asymptomatic or mild COVID-19 positive patients, the *Piper longum* is prescribed to be added in the aqueous extract of *Tinospora sinensis* (Ministry of AYUSH 2020b).

With respect to the herbal decoction 'Ayush Kwath', a simple admixture of four herbal ingredients (namely, *Ocimum tenuiflorum*, *Cinnamomum zeylanicum*, *Zingiber officinale* and *Piper nigrum*) is recommended by the Ministry of AYUSH for management of COVID-19 (Ministry of AYUSH 2021a). The Central Council for Research in Ayurvedic Sciences under the Ministry of AYUSH has developed a poly herbal formulation named as AYUSH-64, which complies with all regulatory and quality requirements. AYUSH-64 is found to be useful for treatment of asymptomatic, mild and moderate COVID-19 infection (Ministry of AYUSH 2021b). Besides, Ashwagandha tablets made up of *Withania somnifera* are recommended for the asymptomatic and mild COVID-19 positive patients during home isolation. Realising the high

potential in herbal medicines such as *Tinospora sinensis*, *Withania somnifera*, *Piper longum* and herbal formulations like AYUSH-64 for management of COVID-19, the Government of India through the Ministry of AYUSH and its constituent institutions has examined these important plants and herbal formulation for clinical safety and needful regulatory compliances. The Ministry of AYUSH has also issued guidelines to the registered practitioners of Ayurveda and Unani for management of COVID-19, which aim to increase awareness among the people for effective home care solutions, AYUSH practices and to enhance immunity (Ministry of AYUSH 2020a, 2021a).

At present, the Government of India ensures to continue promoting evidence-based scientific research on developing plant-based medicines for treatment of COVID-19 (Kotecha 2021). Accordingly, in collaboration with the Ministry of AYUSH the Department of Biotechnology under the Ministry of Science and Technology has been studying the extract of selected medicinal plants (namely, *Andrographis paniculata* and *Ocimum tenuiflorum*) traditionally used for their antiviral properties. The preliminary findings have yielded some encouraging results to develop new plant-based antiviral medicines, in the future, for management of COVID-19 (Sharma 2021). There are continuous attempts to integrate the traditional medical systems and standard care in India, which is still evolving to address the effective management of COVID-19.

CONCLUSION

There is no scientific evidence and claim that the traditional system of medication can cure the COVID-19 disease, however, it may help to improve the immunity system and disinfect the home environment, which may finally help to fight against this deadly disease. Impaired immunity of any individual invites more susceptibility for COVID-19, and hence maintaining immunity is an important aspect to fight against the disease. Besides, the traditional system of medicine in India is an integrated system of therapy, which includes use of medicinal plants, proper yoga practices, and to follow a proper lifestyle. The majority of people in India rely upon

one and other forms of traditional medical system, including decoction of plants and steam inhalation. Among the medicinal plant species, *Ocimum tenuiflorum*, *Tinospora sinensis* and *Zingiber officinale* are the most preferred species to manage COVID-19. There are reports on standardisation and scientific validation of the traditional medical knowledge, which indicate some encouraging results so far.

RECOMMENDATIONS

The traditional system of medicine, including Ayurveda, advocates for building and maintaining immunity to combat diseases, and accordingly many herbal formulations as prepared for enhancing immunity may be used to fight against COVID-19. In addition, the medicinal plants, as prescribed by the practitioners of traditional systems of medicine for management of COVID-19, need to be tested clinically for standardising the level of their effectiveness and safety. Realising the significance of traditional system of medicine, there is a need of systematic documentation and continuous research on such an age-old healthcare system.

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