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SOME IMMUNITY-BOOSTING PLANTS USED DURING THE COVID-19 PANDEMIC TO PREVENT CORONA VIRUS INFECTION IN KUMAUN HIMALYAN REGION OF UTTARAKHAND, INDIA

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ABSTRACT

The entire world is entrapped by the contagious, lethal infectious Corona disease, brought about by the extreme intense respiratory syndrome corona virus 2 (SARS-CoV-2). The second wave of the Covid-19 pandemic has been more devastating than the first. The arrival of corona virus vaccines has meant good news for resuming a normal life. However, there are some cases that have been reported that the persons who have been vaccinated still test positive for COVID-19. Unlike the first wave (in 2020), the younger population is getting infection by a corona virus, especially those with comorbidities are at high risk. Evidence from the first wave of data on the mortality rate also suggests that people with weak immune systems, e.g., older people, children, and those with underlying medical issues, are more likely to be affected by Covid-19 disease. Therefore, by improving the human body's immunity, the risk of SARS-CoV-2 infections can be reduced. In this regard, medicinal plants can play an effective role in improving the body's immunity. Thus, in this paper, attempts are made to compile and discuss the use of various plants to boost immunity and also for the prevention of many respiratory diseases having symptoms and signs similar to Corona disease.

Keywords: Immunity, Covid-19, Medicinal plants, Vaccines

INTRODUCTION

After the Second World War, the COVID-19 outbreak was considered the biggest and greatest challenge for humankind. As of June 20, 2021, the World Health Organization reported 177 866 160 confirmed cases in 216 countries, areas, or territories, resulting in 3857974 confirmed deaths (Weekly operational update on COVID-19-June 22, 2021). On March 11, 2020, the first case of COVID-19 was reported in Wuhan City (China), and due to its high transmission rate, WHO declared this disease as a pandemic. The causative agent of this pandemic is the seventh known virus of the Coronaviridae family, known as SARS-CoV-2 (severe acute respiratory syndrome coronavirus-2) (Cheepsattayakorn and Cheepsattayakorn, 2020). Common symptoms of this disease include fever, cough, sneezing, and shortness of breath. In severe infection conditions, the coronavirus attacks the patient's lung alveolar epithelial cells, resulting in progressive respiratory failure. The complication of disease begins with the virus's receptor-binding domain (RBD) attaching to the angiotensin-converting enzyme-2 (ACE2) receptor in the respiratory tract (Ren *et al.*, 2020). Furthermore, viral infection can cause inflammation, which results in the production of proinflammatory cytokines. This increasing level of cytokines in a patient's blood is a measure of the severity of the infection (Huang *et al.*, 2020). At present, there are no proven medicines for the complete cure of COVID-19, **therefore**, the government issues recommendations to prevent the transmission of this

pandemic among people through hygienic standards, limited contact up to complete self-isolation, and strengthening of the body's immune system, which will protect and also lead to recovery in the event of infection.

During the COVID-19 pandemic, the Kumaun Himalayan population used traditional herbal medicines to prevent this disease. People consumed plant parts by making decoction (kahda) or herbal supplements containing active substances including echinacea, quinine, and curcumin, which have antibacterial or antiviral, anti-inflammatory, and immunostimulatory properties. These herbal substances are thought to have the ability to influence immune responses positively, and, as a result, they may be useful in preventing or treating COVID-19. (Sharma *et al.*, 2009; Kocaadam and Sanlier, 2017; Khan *et al.*, 2021). Therefore, the present study documented medicinal plants used for enhancing immunity during Covid-19 as well as post-Covid life.

MATERIAL AND METHODS

The study was conducted from January–June 2021. Information and data related to medicinal plants with immunity strengthening properties, was collected by extensive literature review. Databases were cross checked by Google scholar and Scopus articles. Information in support of the study was also collected through interviews with local inhabitants and Vaidyas also.

RESULTS AND DISCUSSION

During Covid pandemic medicinal plants have attracted the attention of several stakeholders around the world. It is well known that corona virus severely affects lungs. Therefore, specific consideration was paid to plants that can protect the lungs and boost the body's immunity. Kumaun Himalaya region is rich in traditional medicine, especially in folk medicine (ethnomedicine). Few of them are documented here that may be helpful in the prevention and treatment of COVID-19.

Plums (*Prunus domestica*)

Plums contain many bioactive compounds including carbohydrates, carotenoid pigment, abscisic acid, tannins, anthocyanins, glycosides, flavonoids, dihydroflavonols, lignans, quinic acid, and bipyrrroles (Kayano *et al.*, 2004; Kikuzak *et al.*, 2004; Mahmood *et al.*, 2009; Jaiswal *et al.*, 2013; El-Beltagi *et al.*, 2019). Mature fruits of the *Prunus domestica* have rich content of vitamin C. It has been reported as strengthening immunity, prevention of asthma, anemia, improving the eyesight, treating arthritis, cardiovascular diseases, and hypercholesterolemia (Shahidi *et al.*, 2013; Parihaar *et al.*, 2014). Its various pharmacological activities have also been reported such as anti-cancer, respiratory tract diseases, anti-diabetic, measles, gastric problems, anti-obesity, dyspepsia, nausea, vomiting, thirst, bilious fevers, liver diseases, analgesic, antioxidant, anxiolytic, and gynecological problems (Ferrel 1998; Soni *et al.*, 2011; Yaqeen *et al.*, 2013).

Khubani (*Prunus armeniaca*)

Apricot is the popular name for khubani. Its delicious, high-fiber fruit is yellow-peach in colour and helps in the maintenance of healthy cholesterol and blood sugar levels. Khubani is also high in vitamin A, C, and E, as well as fibre. The presence of vitamin C, vitamin E, carotenes, polyphenols and flavonoids makes it great antioxidant used to fight cancer and boost the immune system (Chanwitheesuk *et al.*, 2000; Shrivastav and Lata, 2019). Fever, cough, cold, bronchitis, laryngitis, haemorrhages, anaemia, and some cancers have all been traditionally treated with apricot (Shrivastav and Lata, 2019). Apricot has also been reported to exhibit antimicrobial, sedative, anti-inflammatory, antispasmodic, anticestodal, antitussive, antinociceptive, antimutagenic, enzyme inhibitory and tonic effects (Yigit *et al.*, 2009; Erdogan-Orhan and Kartal, 2011; Raj *et al.*, 2012; Minaiyan *et al.*, 2014; Sharma *et al.*, 2014).

Hisalu/Hinsar (*Rubus ellipticus*)

It is among the top ten wild edible medicinal plant and also known as Yellow Himalayan raspberry. Hisalu fruit contains various phytochemicals such as anthocyanin, ascorbic acid, phenolics, antioxidants, flavonoids, and minerals like phosphorus, calcium, magnesium, potassium. Therefore, it has traditionally been treated for coughs, fevers, sore throats, and coronary heart problems (Sharma *et al.*, 2019). The juice of Hisalu fruits is used to cure fever, cough, colic and sore throat (Pandey and Bhatt, 2016). The consumption of fruits is also beneficial to overall health and well-being, as well as lowering the risk of chronic diseases. Various parts of Hisalu plants have been used to treat diabetes, epilepsy, diarrhea, analgesia, and dysentery, and also have antioxidant, antifertility, and antimicrobial

properties (Sarong and Sewang, 1994; Vadivelanet *et al.*, 2009).

Malta (*Citrus sinensis*)

The fruit Malta contains minerals such as potassium and calcium, which help improve body's immune system by controlling infectious germs in blood (Goswami, 2020). It is also an effective antioxidant that naturally builds immune system (Etebu and Nwauzoma, 2014). It has been traditionally used to treat ailments such as bronchitis, tuberculosis, cough, cold, cramps, colic, diarrhea, obesity, anxiety, menstrual disorder, angina, constipation, hypertension, depression, and stress (Milind and Chaturvede, 2012). It is effective against pneumonia, high blood pressure, stomach, intestinal problems, and disorders related to the deficiency of vitamin C. At present time, many doctors recommend malta fruit for improving our immune system (for covid 19). Malta juice can also be consumed by preparing tea and is called malta tea.

Kaphal/ Box berry (*Myrica esculenta*)

The plant is known for its delicious fruits and its nutritional and therapeutic properties (Dhani, 2013). In Ayurveda, kaphal is being used for treating bronchitis and asthma (Kirtikar and Basu, 1999; Panthari, *et al.*, 2012). It contains vitamin C, carotenoids, and various polyphenolic compounds (tannins, phenols, flavonoids, and flavonols) (Nadkarni, 2002). Of these phytochemicals, polyphenols are reported to have antioxidant activity, antiviral, antimicrobial, and anti-inflammatory (Narayana *et al.*, 2001). Volatile oil isolated from its bark has proven as an antibacterial agent against Gram +ve and Gram -ve bacteria (Agnihotri *et al.*, 2012).

Ashwagandha (*Withania somnifera*)

Withania somnifera is an herbaceous plant with several health benefits. Ashwagandha has strong immunostimulatory properties and is therefore also known as a blood tonic. It promotes the production of bone marrow, semen and also has anti-aging properties (Umadevi *et al.*, 2012). Ashwagandha contain an active component of Withaferin A, which acts as an anti-carcinogenic agent for treating several cancers (Dutta *et al.*, 2019). In Ayurvedic system of medicine, Ashwagandha is being used to treat tumors, inflammation, arthritis, asthma, and hypertension (Mishra *et al.*, 2000).

Garlic (*Allium sativum* L.)

It is an aromatic herbaceous plant that contains a variety of chemicals that have the potential impact on the body's immunity. Garlic is used as a food and a traditional treatment for a variety of ailments all over the world (Percival, 2016; Batiha *et al.*, 2020). It possesses several biological properties, including immunomodulatory, antimicrobial, anti-inflammatory, antimutagenic, antitumor anticarcinogenic, antioxidant, antidiabetic, and antihypertensive activities in traditional medicines. Garlic has also been observed to reverse the majority of immune system dysfunctions seen in COVID-19 patients (Donma and Donma, 2020).

Tulsi (*Ocimum sanctum* Linn.)

Tulsi is a small herb that grows throughout India. In the Ayurveda system of medicine, tulsi is known as "The Incomparable One", "Mother Medicine of Nature" and "The Queen of Herbs". Its leaves contain various phytonutrients,

vitamin A and vitamin C (Upadhyay, 2017). Tulsi is often used to cure arthritis, bronchitis, asthma, malaria, diarrhoea, persistent fever, dysentery, skin illnesses, painful eye conditions, insect bites, and other ailments. Tulsi has been shown to have antibacterial, antiviral, and antifungal properties (Upadhyay, 2017). Tulsi leaf is also thought to boost immunity when consumed on an empty stomach. The alcoholic extract of Tulsi has been shown to modulate the body's immunity. (Vasudevan *et al.*, 1999). Leaf's extract of *Ocimum sanctum* is also used to prepare herbal hand sanitizer (Mondal *et al.*, 2011; Wani *et al.*, 2013). It is also believed that consumption of Tulsi leaf on an empty stomach increases immunity. Experimental studies have also proved that alcoholic extract of Tulsi modulates immunity.

Grape (*Vitis vinifera*)

Grape is a rich source of important phytochemicals, with anticarcinogenic, immunomodulatory, anti-diabetic, anti-atherogenic, neuroprotective, anti-obesity, anti-aging, and anti-infection properties. (Yadav *et al.*, 2009). *Vitis* contains various bioactive compounds, which have antioxidant activity; therefore, the consumption of grapes prevents oxidative damage. It has been reported that bioactive compounds from grape juice (Castilla, 2006), wine 2003 (Goldberg *et al.*, 2003; Frank *et al.*, 2003), and proanthocyanidins from grape seed extract have antioxidant properties (Sano *et al.*, 2003). Grapes and grape products include chemicals from the proanthocyanidin and anthocyanin families, which may assist to maintain or boost the immune response (Percival, 2009).

Pepper mint/ Pudhina (*Mentha piperita* L.)

Peppermint (*Mentha piperita* L.), is a perennial and strongly scented medicinal herbaceous plant that has many health benefits for human society. It is considered as an astringent, antiseptic, antipruritic, antiemetic, carminative, vermifuge, diaphoretic, analgesic (Gardiner, 2000). In respiratory congestion, peppermint oil vapors can be used as an inhalant. Peppermint tea is frequently used to relieve indigestion and gas problems (Forster, 1996; Mimica-Dukic *et al.*, 2003); it may also be used to treat coughs, bronchitis and inflammation of the oral mucosa and throat. The role of its essential oils is reported in the treatment of patients with infiltrative pulmonary tuberculosis (Shkurupii *et al.*, 2006). Peppermint oil has antibacterial properties against both gram-positive and gram-negative bacteria (Diaz, 1988). Peppermint also has antiviral and antifungal properties (Chaumont and Senet, 1978; Reichling *et al.*, 2009). Menthol has antiviral properties and is effective against influenza, herpes, and other viral infections. (Schuhmacher *et al.*, 2003; Bekhit *et al.*, 2011; Brand *et al.*, 2016). Peppermint is also rich in polyphenolic compounds, which function as powerful antioxidants (Dorman *et al.*, 2003; Riachi and De Maria, 2015; Mairapetyan *et al.*, 2016). Various reports suggest that peppermint helps to support the immune system of the body against viruses (Lv *et al.*, 2012; Ameri *et al.*, 2016).

Ginger (*Zingiber officinale*)

Ginger is a perennial herbaceous plant whose tuberous root or rhizome is commonly used in folk medicine and as a spice. In Ayurveda, it is called "MahaAushadhi". Ginger is used to cure colds, headaches, nausea, rheumatism, muscle pain, inflammation, and arthritis in Ayurvedic, African, Chinese, and Arabic, traditional medicine systems (Baliga *et*

al., 2011; Deghani *et al.* 2011). Its rhizome contains minerals like iron, calcium, phosphorous, and vitamins such as thiamine, riboflavin, niacin, and vitamin C (Khan *et al.*, 2016). Ginger helps to maintain proper circulation, nerve conduction, heart functions, and balance digestive mechanism, which is beneficial in the enhancement of the body's immunity (Dissanayake, 2020). It has also been observed that ginger rhizome extract has immune-boosting effects in both smokers and non-smokers, possibly due to greater antibody response or humoral protection against infections (Mahassni and Bukhari, 2019). Fresh rhizome of *Z. officinale* has been shown to have antiviral effects against HRSV (Human Respiratory Syncytial Virus) infection via generating plaque in respiratory mucosal cell lines (Chang, 2013).

Haldi (*Curcuma longa*)

Curcuma longa is one of the most useful perennial herbaceous medicinal plants. Most of the activities of turmeric are due to curcumin, a natural polyphenol found in its rhizome. In Ayurveda, turmeric is being used to treat skin diseases, fevers, leukoderma, inflammations, constipation, intestinal worms, diarrhea, rheumatism, body ache, and leukoderma (Jain and DeFilipps, 1991). Curcumin has antiviral effects against a variety of viruses, including the influenza virus, Respiratory Syncytial Virus (RSV), Hepatitis B, Hepatitis C, adenovirus, coxsackievirus, Human NoroVirus (HuNoV), papillomavirus, and Herpes simplex 1 virus. (Maheshwari *et al.*, 2006; Dulbecco and Savarino, 2013; Koohpar *et al.*, 2015; Sayer, 2015; Gupta *et al.*, 2017).

Peach/Aadu (*Prunus persica*)

Prunus persica is an important and useful medicinal plant having a wide range of medicinal properties. Peach fruits show essential biological activities and prevent many diseases as it contains many secondary metabolites, such as phenolic compounds that work as antioxidants. Ascorbic acid (vitamin C) and carotenoids (provitamin A) are abundant in peach fruit (Tomás-Barberán *et al.*, 2001a; Tomás-Barberán *et al.*, 2001b; Byrne, 2002; Lurie and Crisosto, 2005). The leaves of the peach plant are used to treat gastritis, whooping cough, and chronic bronchitis (Kritikar and Basu, 1984). Peach leaf extract also showed an immunotropic and anti-inflammatory effect (Lenchuk *et al.*, 2014; Upry, 2016).

Stinging nettle/ Bichchhubuti (*Urtica dioica*)

Urtica dioica L. is a perennial herbaceous plant, which is commonly known as stinging nettle. Many studies have found that this plant is high in vitamin C, protein, and minerals including iron, calcium, and magnesium (Sundriyal and Sundriyal, 2001; Krystofova *et al.*, 2010; Kowol *et al.*, 2011; Rafajlovska *et al.*, 2013). Traditionally, the leaves and roots of *Urtica dioica* have been used to treat jaundice, nephritis, nasal and menstrual hemorrhage, rheumatism, eczema, diarrhea, and as a blood purifier (Khare, 2007; Rafajlovska *et al.*, 2013). Various pharmacological activities of this plant have also been reported, such as antiviral (Wetherilt, 1992), antibacterial, antifungal, antioxidant (Gulcin *et al.*, 2004; Hadizadeh *et al.*, 2009; Krystofova *et al.*, 2010), anti-inflammatory, anticancer (Koch, 2001), immunomodulatory (Akbay *et al.*, 2003) and cardiovascular effects (Alisi *et al.*, 2008). *Urtica dioica* agglutinin (UDA), a bioactive compound in *Urtica dioica*, has antiproliferative

and immunomodulating activity (Le Moal *et al.*, 1992; Franciskovic *et al.*, 2017)

Bakain (*Melia azedarach* L.)

Melia azedarach L., a close relative of the Neem tree (*Azadirachta indica*), is a small to medium-sized evergreen tree native to India. Traditionally, the gum-like substance exuded from its trunk is used to cure spleen enlargement and its wood extract is thought to be effective in the treatment of asthma (Dhiman, 2003). A peptide "Meliacine" reported from *M. azedarach* leaves can inhibit the replication of several viruses like Poliovirus, Foot and mouth disease virus (FMDV), Vesicular Stomatitis Virus (VSV), Herpes Simplex Virus (HSV) (Wachsmann *et al.*, 1982; Wachsmann *et al.*, 1998). *Melia azedarach* is also the source of various bioactive compounds, such as polyketide citrinin from roots, which have antibacterial properties and phenylpropanoids amides from the root bark have anticancer, antioxidant, antimicrobial, anti-inflammatory, and immunosuppressive properties (Pimentel *et al.*, 2011).

Maidenhair fern (*Adiantum capillus-veneris* L.)

Due to its beneficial pharmacological properties, *Adiantum capillus-veneris* is being used in traditional and modern systems of medicine. Various alkaloids and bioactive components have been isolated and identified which are responsible for their therapeutic properties. The decoction of the *A. capillus-veneris* fronds was reported to cure asthma, dyspnea, coryza, chest pain, and cleanse the respiratory system (Brahmachari *et al.*, 2003). Tea or syrup of its fronds has also been used in the treatment of bronchitis, throat afflictions, and coughs (Foster and Duke, 2000).

Siriphal (*Aegle marmelos*)

Aegle marmelos have great capability to cure various diseases (cholesterol, peptic ulcer, inflammation, diarrhea, and dysentery, anticancer, cardio protective, anti-bacterial, anti-fungal, radio protective, anti-pyretic, analgesic, constipation, respiratory infection, antioxidant, hepatoprotective and wound healing properties). Add a few black pepper seeds and half a teaspoon of black cumin to the juice of its leaves, along with an equal quantity of sesame oil, and heat completely. The administration of this combination on a regular basis helps to build resistance to colds and respiratory infections (Sharma *et al.*, 2007; Patel *et al.*, 2012).

CONCLUSIONS

The body's immune systems play an important role in fighting against various disease-causing agents like viruses, bacteria, fungi, *etc.* To strengthen immunity, many allopathic medicines are present on the market, but few of them have side effects. Although herbal compounds are often perceived as "natural" and therefore safe, unfortunately, there is limited scientific evidence about promising potential uses, safety, and efficacy of most herbal products. More than ever, there is a need for conducting extensive research for experimenting to establish the standard formulation. Therefore, the present study will provide brief knowledge about medicinal plants of the Kumaun Himalayan region with opportunities to identify the right medicinal plants having potential capabilities to be evaluated and developed as effective remedies for the management of COVID-19.

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