

IMMUNITY BOOSTER: ROLE OF MEDICINAL PLANTS AND HERBS

Abstract

The whole world was facing COVID-19 epidemic, and everyone was showing lot of interest to invest and study ways to boost our vulnerable immune system, and make an attempt to help human beings for getting first line of defence against the deadly bug. Since ancient times, medicinal herbs, pulps and spices were well known for their medicinal parcels. thus, the medicinal herbs and pottages plays a critical part to boosting our impunity during the COVID- 19 epidemic. it's also veritably important to consume supplements in the form of vulnerable nutrients similar as vitamin A, C, E, D, Bcomplex, Zinc and Cu that will support your body to fight against the pathogens. This paper presents an analysis of popular vulnerable immune boosting medicinal herbs and sauces.

Keywords: Medicinal herbs, COVID- 19, Coronavirus, immunity, SARS- CoV- 2.

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I. INTRODUCTION

COVID-19 primarily affects individuals with weakened immune systems, particularly those under 12 years old and over 75 years old. The immune system relies on beneficial live bacteria in the gut to protect the body from bacteria and emerging viruses. When the immune system is compromised, whether due to age or conditions like diabetes, heart disease, or cancer, it becomes susceptible to infections like coronavirus. In this review, we explore the medicinal value of various botanical plants, which can serve as a valuable resource against COVID-19. Examples of such plants include Garlic (*Allium sativum*), Neem (*Azadirachta indica*), Tulsi (*Ocimum sanctum*), Giloy (*Tinospora Cordifolia*), Clove (*Syzygium aromaticum*), Ginseng (*Panax quinquefolius*), Betel vine (*Piper betel*), Black pepper (*Piper nigrum*), Black cumin (*Nigella sativa*), Ashwagandha (*Withania somnifera*), Licorice (*Glycyrrhiza glabra*), Turmeric (*Curcuma longa*), Elderberry (*Sambucus nigra*), among others. These plants are known to be rich in antioxidants, vitamins, proteins, carbohydrates, dietary fibers, amino acids, minerals, steroids, alkaloids, and various antiviral and antibacterial phytochemicals, which can help strengthen the immune system and combat infectious agents. Many of these botanicals are considered effective for both the prevention and treatment of COVID-19, including Elderberry (*Sambucus nigra*), Garlic (*Allium sativum*), Ginger (*Zingiber officinale*), Giloy (*Tinospora cordifolia*), Tulsi (*Ocimum sanctum*), Betel leaf (*Piper betel*), Neem (*Azadirachta indica*), Turmeric (*Curcuma longa*), Clove (*Syzygium aromaticum*), Black pepper (*Piper nigrum*), Ginseng (*Panax quinquefolius*), Black cumin (*Nigella sativa*), Astragalus (*Astragalus glycyphyllos*), Ashwagandha (*Withania somnifera* and *Withania coagulans*), and Cinchona (*Cinchona officinalis*). These botanicals offer a promising avenue for strengthening immunity and combating COVID-19.

1. Immunity: Immunity, or the state of being resistant to harmful agents or processes, particularly pathogens or communicable diseases, can occur naturally or be acquired through previous exposure or immunization. The body's immune system plays a vital role in defending against invading microorganisms, such as bacteria and viruses, as well as cancer cells. This complex system generates immune responses to protect the body from external substances, cells, and tissues that may pose a threat. It encompasses various components within the body, including the thymus, spleen, lymph nodes, extensive lymphoid tissue (like that found in the gastrointestinal tract and bone marrow), macrophages, lymphocytes (including B cells and T cells), and antibodies.

Immunity, which safeguards against infectious diseases, comprises both innate and adaptive components. Innate immunity is a universal defense mechanism found in all multicellular organisms, while adaptive immunity is a more specialized and precise defense mechanism that is unique to vertebrates.

In summary, immunity involves natural resistance and acquired protection against harmful agents, and it is governed by both innate and adaptive immune components. Innate immunity is present in all organisms, while adaptive immunity is exclusive to vertebrates.

2. Innate Immunity: Innate immunity is a defense mechanism present in all multicellular organisms, encompassing immune responses such as provocative responses and phagocytosis. It serves as the initial line of defense against infectious threats, delivering a rapid response within minutes of encountering a pathogen. Notably, innate immunity is

non-specific, meaning it doesn't target a particular pathogen, lacks immunological memory, and doesn't confer lifelong immunity to the host. This essential component of the immune system is universally found in various forms across both plant and animal life.

The innate or inborn immune system primarily functions to protect the body against infectious diseases by swiftly responding to pathogen attacks. It achieves this by establishing barriers that prevent viruses, bacteria, parasites, and other harmful foreign entities from entering or proliferating within the body. The innate immune system includes:

- **Physical Barriers:** Such as skin, the gastrointestinal tract, the respiratory tract, the nasopharynx, cilia, eyelashes and other body hair.
 - **Defense Mechanisms:** These include various bodily secretions like mucous, bile, gastric acid, saliva, tears, and sweat. In addition, the innate immune system exhibits a range of immune responses such as inflammation, irritation, the cough reflex, and non-specific cellular reactions. The inflammatory response is a robust reaction that mobilizes immune cells to the site of infection by increasing blood flow to that area. Complement is an immune response that tags pathogens for destruction and creates breaches in the cell membrane of the pathogen.
- 3. Adaptive Immunity:** The adaptive component, in contrast, involves more advanced lymphatic cells capable of distinguishing specific "non-self" elements in the presence of "self." Inflammation is a response to external substances and is referred to etymologically, whereas immune tolerance is described as the lack of response to self-substances. This specificity enables a precise immune response when encountering an invasive pathogen. After exposure to an external organism, there is an initial effector response that eliminates or deactivates the pathogen. Upon subsequent encounters with the same foreign organism, a memory response is triggered, resulting in a quicker immune reaction that eliminates the pathogen and prevents illness. This process is unique to vertebrates.

Adaptive immunity is triggered after exposure to an antigen, either from a pathogen or through immunization. This component of the immune system is activated when the innate immune response is insufficient to control an infection. The adaptive response relies on information from the innate immune system to function. There are two types of adaptive responses: the cell-mediated immune response (regulated by T cells) and the humoral immune response, controlled by activated B cells and antibodies. Activated T cells and B cells specific to molecular structures on the pathogen thrive and attack the invading pathogen. Their attack can directly eliminate pathogens or produce antibodies that enhance phagocytosis of pathogens and disrupt the infection. Adaptive immunity also includes memory to provide lasting protection against reinfection with the same type of invading organism. Upon re-exposure, this memory enables an efficient and rapid response.

Natural immunity occurs after being infected by bacteria or a virus, prompting the immune system to generate antibodies against it. While the infection may make you ill, it primes your body's defenses. If you are exposed to the same bacteria or virus in the future, your immune system recognizes it and mounts a defense with antibodies, reducing the likelihood of infection. This natural immunity can come from a previous infection or from antibodies passed from mother to infant through breast milk, providing temporary protection during infancy when the baby is most vulnerable to infections.

- 4. Artificial Immunity:** Deliberate exposure to limited amounts of an infection assists the body in cultivating artificial immunity, providing protection against various diseases. Antibodies produced through vaccination or serum administration, as opposed to natural infection, typically have a shorter duration of effectiveness.
- 5. Active Immunity:** Active Immunity develops when exposure to a virus or bacterial organism prompts the immune system to generate antibodies in response to the infection. It can be acquired through natural infection or vaccination, where the body produces its antibodies in reaction to the vaccine's antigens.

Passive immunity, on the other hand, occurs when a person is provided with antibodies rather than generating them internally. For example, a newborn baby acquires passive immunity from its mother through the placenta. This type of immunity is acquired from antibodies from another source, such as through breast milk or through non-natural means like antivenom antibodies. It generally doesn't last as long as active immunity.

For centuries, the development of pharmacopoeial, non-pharmacopoeial, or synthetic drugs has extensively relied on medicinal plants rich in bioactive compounds. Herbal medicine has a key advantage: it's easier to obtain compared to prescribed medicines. It helps stabilize hormones, metabolism, and ultimately strengthens the body's natural healing abilities and immune system. According to the World Health Organization, approximately 80% of the world's population relies on herbal medicines for primary health care, particularly in Europe and South Asia. Research indicates that many of these plants not only possess anti-inflammatory properties but also enhance the body's natural immunity. Unlike allopathic medicines, most of these herbs and spices are relatively safe, in contrast to antibiotics, which can have severe and sometimes life-threatening side effects.

II. MEDICINAL PLANTS AND HERBS

- 1. Sambucus Nigra (Elderberry):** *Sambucus nigra* is a flowering plant species belonging to the Adoxaceae family. It goes by various names, including elder, black elder, elderberry, European elder, European elderberry, and European black elderberry. This plant primarily thrives in sunny locations and can adapt to various soil conditions, ranging from wet to dry and fertile. It is typically considered a showy shrub or small tree.

Both the flowers and berries of this plant have a long history of culinary use, particularly in the preparation of cordials and wines. *Sambucus nigra* is commonly found in Europe and Western Asia, where it is known for its scientific name, *Sambucus nigra*, and its intense purple berries. It has been valued for its numerous health benefits over many years. Its chemical composition includes polyphenolic compounds (such as

Anthocyanins, Flavonols, and Phenolic acids), carbohydrates (mainly glucose and fructose), citric acid, terpenes, malic acid, lectins, and other essential nutrients.

In vitro studies have demonstrated that liquid elderberry extract exhibits antiviral activity against influenza and respiratory bacterial pathogens. Preclinical animal studies indicate that elderberry (*Sambucus nigra* L. (Adoxaceae)) may prevent the replication and attachment of the human coronavirus NL63 (HCoV-NL63). Early evidence suggests that elderberry is among the most effective methods for preventing or combating coronavirus infections.

Nutritionally, one cup of elderberries contains 106 calories. Per 100 grams, elderberries provide approximately 870 mg of Vitamin A, 1.86 mg of Iron, 391.33 mg of Potassium, 34.10 mg of Vitamin C, 28.06 mg of Calcium, 217 mg of Sodium, along with trace amounts of other minerals, folic acid, amino acids, and dietary fiber. Elderberry, rich in flavonoids with antioxidant and anti-inflammatory properties, helps protect healthy cells from the harmful effects of free radicals. This makes it beneficial for skincare and boosting the immune system, aiding the body in defending against flu, colds, and other respiratory infections.

- 2. Allium Sativum (Garlic, Lahsun):** *Allium sativum* belongs to the bulbous flowering plant species within the *Allium* genus. It shares close botanical relations with onion, shallot, leek, chive, Welsh onion, and Chinese onion. This plant has a rich history of human consumption and use, spanning several thousand years. Native to South Asia, Central Asia, and northeastern Iran, garlic has been employed as a seasoning in global cuisine. Ancient Egyptians recognized its value, using it both as a food flavoring and a traditional medicine. Garlic plays a role in reducing stress and managing high blood pressure.

Garlic boasts potent antioxidant properties, and an impressive 76% of the world's garlic supply originates from China. It aids in preventing beriberi and facilitates the absorption of thiamine (vitamin B1) in the body. In cases of colds, flu, or COVID-19, its antiviral attributes contribute to reducing the severity of infections. Garlic effectively enhances the responsiveness of the immune system, aiding in the defense against viruses and other diseases. Allicin, a broad-spectrum antibiotic found in garlic, stimulates protective white blood cells such as NK cells and macrophages, bolstering immune health.

In vitro studies have indicated that extracts from *Allium sativum* L. (Amaryllidaceae) inhibit the synthesis of viral nucleoproteins and polymerase activity, thereby hindering the influenza A (H1N1) virus. There's also a suggestion for using a decoction of *Allium cepa* L. (Amaryllidaceae) for treating colds. To maximize its benefits, it is advisable to chop or crush garlic before consumption, as it reacts effectively when exposed to oxygen. Garlic is widely embraced worldwide to enhance the flavor of nearly every type of cuisine.

- 3. Zingiber Officinale (Ginger):** Ginger, a flowering plant, is renowned for its rhizome, commonly referred to as ginger root. This rhizome finds extensive use as both a spice and a traditional medicinal remedy. Ginger plants are characterized by herbaceous perennial growth with narrow leaf blades, growing atop annual false stems composed of rolled leaf

bases, reaching approximately one meter in height. Belonging to the family Zingiberaceae, ginger holds great significance as a medicinal plant.

The anti-inflammatory, antifungal, and anti-cancer properties of ginger are well-documented in traditional medical literature. Throughout history, ginger has been widely employed for its therapeutic attributes in addressing various health concerns, including the treatment of colds, asthma, coughs, nausea, morning sickness, travel sickness, arthritis, gastrointestinal complaints, and even depression.

Ginger tea is prepared by crushing ginger and boiling it with tea leaves and water. Ancient remedies for digestive ailments often included ginger powdered combined with crushed cloves, cardamom, and caraway seeds. Ginger proves beneficial in combatting respiratory issues by alleviating congestion associated with the common cold. Additionally, its high antioxidant content contributes to strengthening the immune system. The unique blend of its robust aroma and remedial properties makes ginger effective in stress relief. Moreover, ginger aids in improving blood circulation, thanks to its rich array of vitamins, minerals, and amino acids, which prevent fat deposition in arteries, ultimately reducing the risk of cardiovascular disorders.

- 4. *Tinospora Cordifolia* (Giloy, Guduchi):** Widely recognized as gurjo, heart-leaved moonseed, guduchi, or giloy, this herb is native to tropical regions within the Indian subcontinent and belongs to the Menispermaceae family. In Ayurveda, it has long been utilized for its efficacy in treating a multitude of disorders. Scientifically referred to as *Tinospora cordifolia*, giloy boasts a rich history of medicinal use spanning centuries.

Numerous *in vitro* and *in vivo* studies focusing on giloy have consistently highlighted its various therapeutic properties, including being hypolipidemic, hepatoprotective, antibacterial, hypoglycemic, anti-inflammatory, antiosteoporotic, antiobesity, anticarcinogenic, and antimutagenic. The composition of Guduchi or Giloy herb is known to encompass various diterpene components and polysaccharides, including arabinogalactan polysaccharides, which exhibit immunomodulating and adaptogenic characteristics.

Multiple studies have demonstrated that herbal extracts of Giloy can significantly enhance IgG antibodies present in the serum. Furthermore, it stimulates macrophages, induces cell-regulated immunity, and augments humoral immunity, reinforcing its reputation as a valuable natural remedy.

- 5. *Ocimum Sanctum* (Holy Basil, Tulsi):** Tulsi, an aromatic perennial plant, is commonly known as holy basil, tulsi, or tulasi, and it falls under the Lamiaceae family. This herb is native to tropical and subtropical regions of Australia, Malesia, Asia, and the western Pacific. Tulsi is widely cultivated in Southeast Asian tropical regions for its agricultural and environmental benefits. Additionally, it has escaped cultivation and become naturalized in numerous tropical regions of the Americas.

Extensive clinical and preclinical *in-vitro* and *in-vivo* studies have consistently highlighted the therapeutic potential of tulsi. These studies have demonstrated its properties as an antioxidant, anti-aging agent, anticancer substance, antiviral and antimicrobial agent, antipyretic remedy, anti-arthritic treatment, and solution for various

health issues such as gum ulcers, kidney problems, earaches, menstrual irregularities, arthritis, anorexia, and malaria. Moreover, tulsi has been employed as a haemostyptic during childbirth. Intriguingly, there is scientific evidence suggesting the potential role of tulsi in combating COVID-19.

- 6. Curcuma Domestica (Turmeric, Haldi):** Turmeric, scientifically known as *Curcuma longa*, is a flowering plant belonging to the Zingiberaceae family, which is the same family as ginger. This plant is abundantly found in the Indian subcontinent and Southeast Asia. Turmeric, often referred to as the "Indian saffron," is recognized for its vibrant yellow-orange color and serves both as a spice and a medicinal herb with potent anti-inflammatory properties. In Indian cuisine, it is a common ingredient in curries and various other dishes.

The traditional remedy known as "kadha," made by combining chopped ginger, tulsi, and turmeric and consumed daily, is recommended by AYUSH to boost immunity. Turmeric stands as one of the most extensively researched spices, celebrated for its therapeutic potential. One of its primary phytochemicals, curcumin, plays a vital role in enhancing the immune system. Prior research has firmly established its therapeutic properties, including antifungal, antiviral, antioxidant, anti-inflammatory, cardiovascular, and anti-diabetic effects. Additionally, it has demonstrated efficacy in gastrointestinal health, cancer prevention, antimicrobial action, and the protection of liver and kidney functions.

- 7. Syzygium aromaticum (Clove, Laung):** Cloves, the aromatic flower buds hailing from the Myrtaceae family, are indigenous to Indonesia and the Maluku Islands, commonly known as the Moluccas. They serve as a widely utilized spice, adding flavor and fragrance to various products like toothpaste, soaps, and cosmetics. Clove harvesting occurs throughout the year, thanks to the diverse seasons in different countries. The consumption of whole cloves is known to contribute to the development of a robust immune system.

The therapeutic potential of cloves is attributed to the presence of essential oils, which exhibit a range of beneficial properties, including antimicrobial, antifungal, antiviral, anti-inflammatory, analgesic, and anesthetic activities. Clove oil is particularly potent as an antioxidant and is believed to impede the entry of the severe acute respiratory syndrome (SARS) coronavirus into cells during a COVID-19 attack. Additionally, it possesses anti-platelet activity, which aids in preventing the formation of blood clots. Consequently, the essential oil derived from cloves is considered a prominent candidate in the battle against the coronavirus, offering potential protection against the severe outcomes often observed in COVID-19 patients.

- 8. Withaniasomnifera (Ashwagandha):** Ashwagandha, also recognized as winter cherry or Indian ginseng, is scientifically named *Withania somnifera*. This perennial shrub belongs to the Solanaceae family, commonly referred to as the nightshade family. Ashwagandha is a petite shrub adorned with pale green flowers, simple leaves, and red berries. It is prominently found and cultivated in India, the Middle East, and various regions of Africa. Within the genus *Withania*, several species share morphological similarities with *Withania somnifera*, such as *Withania coagulans*.

This plant, especially its root powder and leaf extract, has been employed in traditional Indian medicine for centuries. While the leaves are commonly used to prepare tea, the roots are typically dried, ground into powder, and consumed as a supplement in contemporary times. Ashwagandha extract is renowned for its capacity to lower elevated blood sugar levels, cortisol levels, alleviate symptoms of depression, and possess anti-inflammatory properties. By enhancing cell-mediated immunity, Ashwagandha fortifies the body's defenses against viral and bacterial threats. Its potent antioxidant characteristics safeguard against cellular damage induced by free radicals. Furthermore, it has demonstrated inhibitory effects against various types of cancer (including breast, colon, prostate, ovarian, lung, and brain), elucidating the underlying mechanisms and pathways involved.

- 9. *Planaxquinquefolius* (Ginseng):** Ginseng, often hailed as the "King of Herbs," is a member of the Araliaceae family and belongs to the *Panax* genus, formally known as *Panax ginseng* C. A. Meyer. The primary constituents of ginseng are ginsenosides and gintonin. Various species of ginseng, such as Korean ginseng (*P. ginseng*), South China ginseng (*P. notoginseng*), and American ginseng (*P. quinquefolius*), are recognized for their varying levels of ginsenosides and gintonin. In regions like China and Korea, ginseng finds common usage in both culinary dishes and traditional medicine.

While modern clinical research has not definitively established the medical effectiveness of ginseng, it has been an integral component of traditional medicine for centuries. It's important to note that there is no substantial scientific evidence supporting ginseng's efficacy in the treatment of specific medical conditions, and it has not received approval from US federal agencies as a prescription drug.

During instances of acute respiratory tract infections, whether caused by COVID-19, influenza, or chronic diseases posing significant health risks, ginseng has been employed to bolster the immune system's defense against such infections. Within the Ayurvedic system of medicine, ginseng holds a prominent place, known for its antioxidant properties and its ability to enhance the immune system's functioning.

III. NUTRACEUTICALS AND HERBAL EXTRACTS

Vitamins: Vitamins constitute essential components of our diet and have long been recognized for their influence on the vulnerable immune system. Of late, vitamins A and D have gained significant attention due to their unexpected and crucial impact on the immune response in susceptible individuals. These vitamins, often referred to as "vital amines," are organic compounds that the body requires in minimal quantities through dietary intake because they cannot be synthesized in sufficient amounts within an organism.

Vitamins and their metabolites play indispensable roles in numerous physiological processes, serving diverse functions as hormones and antioxidants, regulators of growth and insulation, contributors to embryonic development, and participants in calcium metabolism, among others. For instance, it has been recently recommended that healthcare workers and smokers should aim for a daily intake of 20-50 µg of vitamin D to fortify their resistance against COVID-19 infection.

Salutary minerals are equally crucial components of our diet, serving a wide range of functions such as fortifying bones, influencing muscle function, and regulating the body's hydration balance. They also act as essential components of hormones, enzymes, and other biologically active compounds. Importantly, certain minerals play a significant role in optimizing the functioning of the vulnerable immune system.

- **Selenium:** The significance of selenium is immense when it comes to ensuring optimal immune function.
- **Zinc:** Elderly individuals are often deficient in zinc, which is essential for immune function.
- **Iron:** Effectively managing serum iron levels could lead to positive clinical outcomes for COVID-19 patients.
- **N-acetyl-cysteine (NAC):** NAC, sourced from the naturally existing amino acid cysteine, is frequently recommended for patients dealing with a range of respiratory issues.
- **Probiotics:** The addition of probiotics through nutritional supplementation has shown benefits for patients experiencing respiratory tract infections.
- **Omega-3 fatty acids:** Omega-3 fatty acids, which have demonstrated their effectiveness in reducing airway inflammation and bronchoconstriction, as well as their efficacy against viral infections (102,103), should be further explored for their potential use against COVID-19.
- **β-glucans:** β-glucans, highly effective in stimulating immune cells, may contribute to reducing morbidity and mortality linked to COVID-19.

IV. CONCLUSION

Medicinal plants and herbs provide healthier alternatives for addressing unforeseen diseases like COVID-19. During the sudden emergence of COVID-19 in December 2019, when no proper allopathic medicine was available, various traditional medicinal plants and herbs were employed as treatments, yielding positive health outcomes for COVID-19 patients. This not only saved lives but also supported many families. The use of these herbs during the pandemic maintained positive energy among patients, showcasing the efficacy of Ayurveda to the world. In this review, we have outlined the potential uses of medicinal plants and herbs to enhance immunity against such viruses.

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