

Botanical Research: Innovations and Insight

ISBN: 978-93-49938-09-0 | Year: 2026 | pp: 63 - 75 |

Significance and Importance of Medicinal Plants in Immune Boosting

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Article DOI Link: <https://zenodo.org/uploads/20508903>

DOI: 10.5281/zenodo.20508903

Abstract

For ages, traditional healthcare systems have relied heavily on medicinal herbs, which are still essential for boosting human immunity. Natural and plant-based treatments that can boost immunity with few adverse effects are becoming more and more popular as infectious diseases and lifestyle-related problems become more common. The bioactive substances found in medicinal plants, such as flavonoids, alkaloids, phenolics, and terpenoids, which have immunomodulatory, antioxidant, and anti-inflammatory qualities, are the focus of this chapter's investigation of the role of these plants in strengthening immunity. The traditional uses of important medicinal plants, including as Tulsi (*Ocimum sanctum*), Ashwagandha (*Withania somnifera*), Giloy (*Tinospora cordifolia*), Turmeric (*Curcuma longa*), and Ginger (*Zingiber officinale*), are addressed together with their scientific validity.

The chapter also discusses recent research results, safety issues, and potential future developments for plant-based immunotherapeutic. All things considered, medicinal plants present viable, affordable, and long-lasting methods of enhancing immune function and averting illness.

Keywords: Medicinal plants, Traditional medicine, Immune system, Healthcare, Immunity

Introduction

The immune system is a complex network of organs, tissues, and cells that work together to protect the body from illnesses and harmful substances. Its main

function is to defend the body from diseases, infections, and other threats. Although the immune system protects the body in most cases, it can occasionally go wrong. Autoimmune diseases can be caused by immune system disorders. This is the state in which the body's tissues are attacked by the immune system or immunodeficiency disorders, which impair immunity and increase susceptibility to infections. Maintaining a strong immune system is essential for overall wellbeing. The goal of this research is to investigate how plants affect the immune system. Immunity is the capacity of humans to fend against harmful microbes, aberrant cells, and foreign substances. The immune system is a group of organs, tissues, cells, and enzymes that work together to defend the body. The host's protection against harmful germs is known as immunity. It is made up of an intricate web of cells and molecules. The immune system is the culmination of all the cells, tissues, and chemicals that protect the host. The immune system's primary physiological role is to either avoid or eradicate illnesses (Centimole, 2022). Globally, there is currently a growing trend and desire for organic and green living. Herbal items made from plants or trees are rich in aromatic compounds and nutritional additives. Natural plant extracts are used in aromatherapy and folk medicine, which are holistic forms of healing that enhance health and wellbeing. (Golechha, 2022; Boukhatem & Setzer, 2020). Herbs are used as bases of medicine in many ways in human beings in their life. Research interest has focused on various herbs that possess immune stimulating properties as a useful feature in helping diminish the risk of cancer. In different herbs, a wide ranging of phytochemicals, have been identified such as the flavonoids, lignans, terpenoids, polyphenolics, sulfides, saponins, carotenoids, curcumins, plant sterols and phthalides. (Khodadadi, 2015). Echinacea, garlic, ginger, and turmeric are examples of medicinal plants that have been used for generations to strengthen immunity and fend off illness. These plants have been demonstrated to have immunomodulatory qualities, which can help strengthen the immune system and fend off illnesses. (Khunteta, 2025)

Importance of a Strong Immune System

To protect the body from dangerous pathogens including bacteria, viruses, fungi, and parasites, the immune system is a highly developed network of cells, tissues, and organs. In order to prevent illness and preserve general health, its effectiveness and strength are essential. In addition to providing defence against infections, a healthy immune system is essential for long-term wellbeing, healing, and illness prevention. The primary function of immune system is to prevent illness. The body can fend against common infections like the flu, colds, and other infectious disorders when it has a strong immune system. The World Health Organization states that maintaining immunity through healthy eating, good cleanliness, immunizations, rest, and exercise is crucial for general health and illness prevention (WHO report 2023).

Factors Affecting Immunity

The immune system is composed of many biological elements and functions that cooperate to maintain your health. The innate immune system and the adaptive immune system, or humoral immunity and cell-mediated immunity, are two different forms of immunity. As the first line of protection against foreign organisms and materials, the innate immune system is composed of biological (pH, temperature, and oxygen levels), chemical (enzymes), and mechanical (mucous membranes and skin) barriers. According to Bergmans et al., (2020) the adaptive immune system is composed of antigen-specific leukocytes known as lymphocytes. Pollution, stress, and other variables that lead to immunological dysfunction have increased despite the fact that modern lives have decreased contact with microorganisms, and it is evident that the current diet damages the immune system. (Deng et al., 2017)



Figure 1 Factors responsible for effecting immune system

Overview of Medicinal Plants

Everything was based on experience because there was not enough knowledge available at the time about the causes of the ailments or about which plant could be used as a remedy. As the rationale behind the use of particular medicinal plants to cure particular illnesses emerged throughout time, the use of these plants increasingly moved away from the empirical framework and toward explanatory facts. Prior to the development of iatrochemistry in the sixteenth century, plants were used for both prophylaxis and treatment. (Kelly 2009). Nowadays, there is a growing demand for and acceptance of medicinal herbs. Without a question, plants contribute significantly to ecosystems by offering vital services. Humans and other living things cannot exist as they ought to without plants.

Table 1 Some Common Medicinal Plants their Ingredient and Purpose

Category	Botanical Name	Common Name	Ingredient	Purpose
Medicinal Plant	<i>Zingiber officinale</i>	Ginger	Gingerols, Shogaols	Has anti-inflammatory, antioxidant, and digestive-enhancing qualities that support immunological response.
	<i>Ocimum tenuiflorum</i>	Tulsi	Eugenol, Ursolic acid, Rosmarinic Acid	Its antibacterial, anti-inflammatory, and stress-relieving properties strengthen immunity.
	<i>Curcuma longa</i>	Turmeric	Curcumin	provides anti-inflammatory and immunological modulation through the potent pharmacological properties of curcumin.
	<i>Beta vulgaris</i>	Beetroot	Betalins, Dietary nitrates	prevents the overreaction of the immune system and lowers inflammation to regulate immunological function.
	<i>Glycyrrhiza glabra</i>	Liquorice	Glycyrrhizin, Licirigenin	enhances immunity through hormone-like action, antiviral, and anti-inflammatory qualities.
	<i>Moringa oleifera</i>	Moringa	Quercetin, Chlorogenic acid	increases immunity due to its rich vitamin, mineral, protein, and antioxidant content.
	<i>Withania somnifera</i>	Ashwagandha	Withanolides	Its rich vitamin, mineral, protein, and antioxidant content boosts immunity.
	<i>Linum usitatissimum</i>	Flaxseed	Alpha-linolenic acid	provides fiber, antioxidants, lignans, and omega-3 fatty acids to support immunological and gastrointestinal health.

(Gulave et. al. 2025)

In any case, medicinal herbs in particular have consistently served as a general indicator of the health of ecosystems. (Singh, 2002). Humans have definitely thought about medicinal plants since prehistoric times. One could argue that prior to

history, early humans were more or less aware of the qualities of the plants they used for clothing, food, shelter, and fuel. One of the oldest sciences in nations like China, Greece, Egypt, and India is the study of medicinal plants. Plants were widely used in ancient Persia as fragrant agents, medicines, and disinfectants (Hamilton, 2004). In actuality, the use of medicinal plants to treat illnesses has existed throughout human history; that is, since people have always looked to their surroundings for tools to help them recover from illnesses, using plants has been their only option (Halberstein, 2005). The use of different plants as Medicinal Plants has become increasingly important in the global health system for both humans and plants (Rehman et al., 2020; Ali et al., 2021).

Traditional Systems of Medicine

The traditional system of medicine is a vast system that is present all over the world. The use of traditional medicine has become very popular in different areas of the world because of the numerous significant effects toward the sustainability of human health and the prevention of several infections and diseases. Traditional medicine is a combination of experience, belief, skill, and knowledge that improves the health, the diagnosis, and the mental and physical condition of individuals.

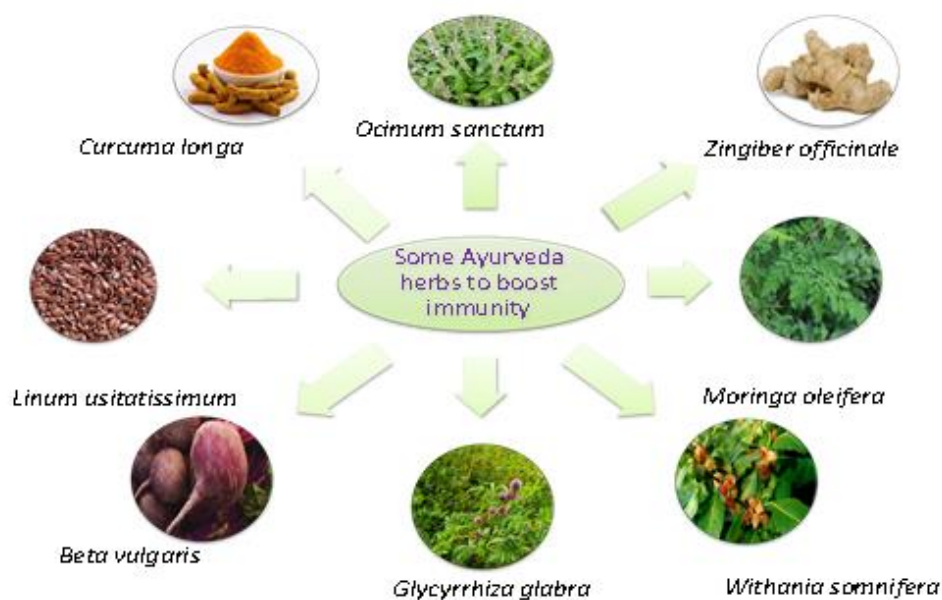


Figure 2 Some local Ayurveda herbs to boost Immunity

People use natural medicines in the form of alternative and complementary medicine. The traditional system of medicine is a vast system that is present all over the world. The use of traditional medicine has become very popular in different areas of the world because of the numerous significant effects toward the sustainability of human health and the prevention of several infections and diseases.

Traditional medicine is a combination of experience, belief, skill, and knowledge that improves the health, the diagnosis, and the mental and physical condition of individuals. People use natural medicines in the form of alternative and complementary medicine. The traditional system of medicine is a vast system that is present all over the world. The use of traditional medicine has become very popular in different areas of the world because of the numerous significant effects toward the sustainability of human health and the prevention of several infections and diseases. Traditional medicine is a combination of experience, belief, skill, and knowledge that improves the health, the diagnosis, and the mental and physical condition of individuals. People use natural medicines in the form of alternative and complementary medicine. The traditional system of medicine is a vast system that is present all over the world. The use of traditional medicine has become very popular in different areas of the world because of the numerous significant effects toward the sustainability of human health and the prevention of several infections and diseases. Traditional medicine is a combination of experience, belief, skill, and knowledge that improves the health, the diagnosis, and the mental and physical condition of individuals. People use natural medicines in the form of alternative and complementary medicine. The use of natural plants has been documented from various parts of the globe, where almost 70% of the population uses natural medicine to improve health-related conditions. The role of natural plant medicine has been documented across the globe for effective and protective health care. They are found in different countries on different continents. All over the world, the traditional medical system is a large system. Due to its many important benefits for maintaining human health and preventing many illnesses and infections, traditional medicine has grown in popularity throughout the world. Traditional medicine improves people's health, diagnosis, and mental and physical conditions by combining experience, belief, skill, and knowledge. Natural remedies are used by people as additional and alternative medicine. Traditional medicine is defined by World Health Organization (WHO) as the entirety of knowledge, skills, and practices based on the theories, beliefs, experiences indigenous to different cultures, whether explicable or not, used in maintenance of health, as well as in the prevention, diagnosis, improvement, or treatment of physical and mental illness. Furthermore, the lengthy history of using herbal remedies is referred to as traditional use. National authorities may approve their use since it is well-established and generally

considered as safe and effective (WHO Report, 2017). There are about 20,000 known medicinal plants in India, but approximately 7,000–7,500 of them are used by traditional healers to treat various illnesses. Ayurveda uses 2000 plants, Siddha 1300, Unani 1000, Homeopathy 800, Tibetan 500, Modern 200, and folk 4500, according to the various Indian medical systems. There are about 25,000 potent plant-based remedies utilized in traditional and folk medicine in India. In India, around 1.5 million practitioners provide medical care within the traditional medical system. Over 7800 manufacturing facilities are thought to produce traditional plant-based formulations and natural health products in India, requiring over 2000 tons of raw materials from medicinal plants each year (Pandey et al., 2008). According to (Patwardhan et al., 2005), around 1500 herbals are marketed as nutritional supplements or traditional ethnic remedies. The traditional medicine in India is the most popular system called the system of Indian medicine. These natural plant-derived systems in India have become so vast that physiotherapists who work in India have divided them into six categories: naturopathy, yoga, Unani, homeopathy, Ayurveda, and Siddha. Each system has gained specific importance over time and proved helpful for human health. In the 18th century, homeopathy came to India and became a greater part of this system; so in the traditional Indian system, homeopathy is also important. Ayurveda has been increasingly significant in India's traditional system. Ayurveda is founded on a conceptual framework, which sets it apart from other systems. Ayurveda is a comprehensive medical system that enhances people's health on a philosophical, physical, ethical, and psychological level. It is more than merely ethnomedicine. Over 10,000 plants are grown for medicinal purposes in India; some of these plants are tasty, while others are utilized for medical purposes. Similar to Ayurveda, Siddha is another medical system in India. Siddhars, who were extremely knowledgeable about the medical system, made the initial discovery of this system. Materia Medica prepares medications using metal and mineral-based materials. Greece is where the Unani medical system first appeared. Hippocrates was the first doctor to propose the idea of medicines derived from plants. Traditional medicine is primarily used in India for primary healthcare. Plant herbs are typically used in infusions and decoctions. Some important medicinal plant mostly cultivated in India shown in table no. 2.1

Phytochemicals, Pharmacological and Their Immunomodulatory Effects

Medicinal plants include bioactive compounds with a variety of structural and functional characteristics. The primary classes of phytochemicals and their pharmacological potentials are summarized in Table 3.1. The efficacy of plant bioactive chemicals against neurodegenerative illnesses, metabolic syndromes, and infectious diseases is part of their pharmacological spectrum. Because of their high efficacy and minimal toxicity, compounds including curcumin, quercetin, resveratrol, and andrographolide have moved from laboratory research to clinical

studies. Furthermore, the synergistic effects of several phytochemicals present in plant extracts might improve therapeutic results a advantage that is sometimes disregarded in synthetic medications that only include one ingredient.

Table 2 Bioactive compounds obtained from medicinal plants and their therapeutic effects

Bioactive compound	Potential	Sources
Alkaloids	Antimicrobial agents, antiviral, antimutagenic, anticarcinogenic, antibacterial, anticonvulsant, analgesic, and antifungal anthelmintic, cardiogenic, anti-bacterial, and inflammatory lower fever, treat intestinal colic, and prevent peptic ulcers. decongestant, uterine contraction agents, angina therapy, treatment for altitude sickness and antirheumatic Parkinson's illness Treatment for traumatic nervous system damage, myasthenia gravis, treatment for hypertension and depression	Adamski et al., (2020) Thawabteh et al., (2019) Heinrich et al., (2021)
Flavonoids	Preventing coronary heart disease, hepatoprotective, anti-inflammatory, antiviral, anticancer, Parkinson's disease, and managing hypertension	Kumar & Pandey, (2013)
Terpenoids	Anti-tumor, anti-malarial, anxiolytic, and anesthetic Asthma, gastric ulcers, wound healing, anti-inflammatory, antimicrobial, antiallergic, and anticancer activities	Masyita et al., (2022)
Phenolics	Anti-inflammatory medications high blood pressure, metabolic issues, Diseases caused by fire, Alzheimer's disease, neurodegenerative disorders, skin conditions, Rheumatoid arthritis Bowel inflammation Antiviral, antibacterial, anticancer, and anti-aging properties Diseases associated with allergies	Rahman et al., (2021)

Mechanisms of Immune Modulation

Immune system modulation is essential for controlling human health and disease processes. The immune system's necessity to eradicate and regulate pathogenic and nonpathogenic microorganisms that can impair the body's capacity to maintain

homeostasis is the reason for its significance. To sustain a successful symbiotic effect, a microbiome of nonpathogenic bacteria must exist in addition to a functioning host immune system. Half of the 35 trillion cells in the human body are descended from humans, and the other half are descended from microorganisms. (Sender et al., 2016)

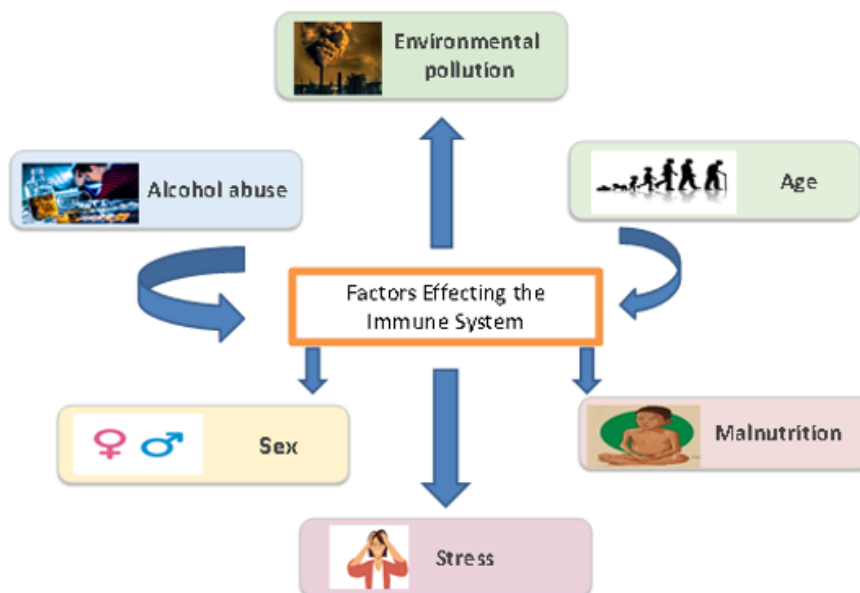


Figure 3 Factor Effecting the immune System

Other antimicrobial medicines have immunomodulatory qualities in addition to being antiviral medications. This issue included a thorough analysis of specific immunomodulatory effects for antifungal, antimalarial, and regularly used antibiotics (macrolides and azole) (Ruh et al., 2017). Antimicrobial medicines' most prevalent immunomodulatory effect is their ability to reduce the inflammatory response to a persistent infection. While most of these medications directly reduce the generation and release of pro-inflammatory cytokines, the reported reductions in the degree of inflammation may also be due to a reduction in the load of pathogens. The adaptive immune response is a protective system that becomes more specialized and customized over time. It involves specialized immune cells called lymphocytes, such as T and B cells. According to Bonilla & Oettgen (2010), lymphocytes' capacity to identify and form memory against certain antigens is essential for the adaptive immune response. In conclusion, the lymphatic system serves as a crucial conduit between the innate and adaptive immune responses, which are the two branches of the immune system. By carrying immune cells and antigens, lymphatic capillaries promote immune cell activation, antigen presentation, and immune response coordination (Dieterich et al., 2014).

Medicinal Plants for Immunity Boosting**Table 3 Some Important Traditional Medicinal Plants Mostly Cultivated in India**

Plant name	Local Name	Part used	Medicinal uses
<i>Aegle marmelos</i>	Bael	Fruit	Chemopreventive and hypoglycemic activity
<i>Acorus calamus</i>	Vach	Rhizome	Antispasmodic effect and a nervine tonic
<i>Aloe barbadensis</i>	Aloe vera	Gel	Treatment of skin disease and wound healing
<i>Andrographis paniculate</i>	Kalmegh	Whole plant	Treatment of flu and cold and shows hepatoprotective effect
<i>Berberis aristata</i>	Daruhaldi or Daruharidra	Stem, root, fruit, bark, and wood	Hypoglycemic, antiprotozoal, and antitrachoma effects
<i>Bacopa monnieri</i>	Brhami	Whole plant	Show antioxidant activity and enhances memory
<i>Callicarpa macrophylla</i>	Priyangu or Daya	Mostly root and leaves	Uterine problems

Source: Akram et al., 2021

The herbal immunity booster, composed of natural ingredients such as Ginger, Tulsi, Turmeric, Beetroot, Liquorice, Moringa, Ashwagandha, and Flaxseeds, demonstrated promising characteristics in terms of sensory appeal, physical stability, and flow properties. Organoleptic assessments confirmed a pleasant taste, aroma, and texture suitable for all age groups, while physicochemical analyses demonstrated low moisture content, ideal pH, and good compressibility, supporting product stability and shelf life. It is even better suited for powder-based supplements because of its uniform particle size and superior flow behaviour.

Conclusion

For generations, medicinal herbs have been essential to preserving and improving human health, especially when it comes to boosting the immune system. These plants, which are rich in bioactive substances such as phenolic acids, terpenoids, flavonoids, and alkaloids, have important anti-inflammatory, antioxidant, and immunomodulatory qualities. They are useful in controlling and preventing a variety of illnesses due to their capacity to control both innate and adaptive immune responses. In recent years, there has been a renewed interest in plant-based therapeutics, driven by increasing awareness of the limitations and side effects associated with synthetic drugs. Medicinal plants such as Tulsi (*Ocimum sanctum*), Ashwagandha (*Withania somnifera*), Moringa (*Moringa oleifera*), Beetroot (*Beta vulgaris*), Liquorice (*Glycyrrhiza glabra*), *Linum usitatissimum* (Flaxseed) and

Turmeric (*Curcuma longa*) have demonstrated promising potential in enhancing immune resilience and overall well-being. Scientific validation through pharmacological and clinical studies has further strengthened their credibility in modern healthcare systems. A important and sustainable resource for boosting immunity is medicinal herbs. Global health could greatly benefit from their incorporation into preventive healthcare measures, particularly in light of the emergence of infectious diseases. To fully realize their potential and further their sensible application in modern medicine, more research and legislative backing will be necessary.

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