

Exploring Herbs Enhancing Immune Functions

Vishwa Patel*, Dr. Nishkruti Mehta¹, Dr. Pragnesh Patani²

¹Associate Professor, Head of the Pharmacology department, Khyati College of Pharmacy, Palodia, Ahmedabad

²Principal, Khyati College of Pharmacy, Palodia, Ahmedabad

***Corresponding Author:** Vishwa Patel

*Khyati College of Pharmacy, Palodia, Ahmedabad, Email: vishwa250703@gmail.com

Abstract:

This review offers a comprehensive analysis of the immunomodulatory effects of various medicinal plants and their active constituents, highlighting the potential of herbal medicine as a multicomponent strategy to enhance the immune system and prevent infections. It underscores the efficacy of several key herbs, including Echinacea, ashwagandha, ginseng, and basil, which are recognized for their ability to boost immune function through different mechanisms. Echinacea, for instance, is well-known for stimulating the immune system and is often used to reduce the duration and severity of colds. Ashwagandha and ginseng, both adaptogens, not only help the body cope with stress but also support immune health by modulating the stress response. Basil, particularly holy basil, is valued for its anti-inflammatory and antioxidant properties, which contribute to overall immune resilience. The review emphasizes the benefits of combining these herbs, as their synergistic interactions can enhance bioavailability and therapeutic efficacy. This approach is particularly relevant in formulations aimed at maximizing immune support, as it allows for a broader spectrum of activity against pathogens. Additionally, the review delves into the factors that influence the concentration of bioactive components in these herbs. It discusses how cultivation conditions, harvesting techniques, and extraction methods can significantly impact the potency and effectiveness of herbal products. The discussion on extraction methods provides insights into how these bioactive compounds are isolated and concentrated, ensuring the quality and consistency of herbal formulations aimed at immune enhancement.

Keywords: Herbs, immune enhancement, Echinacea, basil, ashwagandha, astragalus, turmeric, garlic, immune boosters, natural herbs, immune suppressant

1. INTRODUCTION

The body is shielded from infections and diseases by the immune system, a highly sophisticated network of specialized cells that recognizes, absorbs, and neutralizes alien or dangerous cells. It consists of tissues like the bone marrow, lymph nodes, and spleen, among others, which are essential for the production and storage of particular immune cells. T cells and B cells are the two main subtypes of immune cells. Antibodies, also known as immunoglobulins, are made by B cells and are proteins that recognize and label particular antigens. The job of T cells, however, is to eliminate the antigens that these antibodies have identified. ^[1] To maintain health and fortify the immune system, especially in challenging times, it is essential to focus on immune-enhancing strategies. One effective approach is the use of natural medicinal plants and herbs, which have long been valued in traditional medicine systems like Ayurveda for their immune-boosting properties. These plants are generally safe, with minimal adverse effects, and have been found to possess antiviral and immune-stimulating qualities. Incorporating specific vitamins and herbs known for enhancing immune function is crucial. Many therapeutic plants are recognized for their ability to strengthen the body's defenses by stimulating the immune system. Plant extracts, according to traditional medical research, can significantly bolster the body's resilience. The article provides a list of some of the most significant medicinal herbs that support and enhance immune function, helping to maintain overall health and well-being. ^[2] Recent advancements in leprosy treatment highlight the importance of early diagnosis and novel therapeutic strategies. ^[3]

1.1 Role of Herbs in Immune Function:

It has been discovered that over 300 plants produce over 122 compounds, many of which are employed in medicine today. For instance, the coca plant, which has a high cocaine content, is utilized commercially as a regional anesthetic. N-Hexane extracts of pumpkin seeds have shown antimicrobial activity against a range of bacterial strains. Additionally, the purple foxglove, or *Digitalis purpurea*, has a cardiotonic effect and is high in digitoxin. Nature is the ultimate molecule artisan, having produced a nearly limitless array of molecular things. Common medications that come from plant origins include digitalis, caffeine, aspirin, morphine, and codeine. The application of these therapeutic herbs as immune system modulators is expanding quickly. Numerous studies in this field have led to the conclusion that a variety of phytochemicals, including lactones, alkaloids, polysaccharides, and glycoside derivatives, are immunomodulators that alter the immune system's reaction and

function. *Picrorrhiza kurroa* demonstrates notable antidepressant activity, making it a promising candidate for further research in mental health. Put differently, these substances have the potential to alter the immunomodulatory characteristics. Rather than treating and curing disease, there is a growing interest in using herbal medicine as a multicomponent agent to modify the intricate immune system in order to avoid infection. In light of this, this review will provide an overview of the components of plant derivatives that have been extensively studied as well as their powerful immunomodulatory effects. Lycopene in tomatoes has been linked to reduced risks of chronic diseases, particularly cardiovascular diseases. [4, 5, 6, 7]. An herb's effects are frequently the sum of the actions of its individual ingredients. For instance, as demonstrated by *A. membranaceus*, the overall rise in B cells is because of the interplay between the declines in IFN- γ and IL-6. Numerous factors impact the level of concentration of the herb's bioactive components. The ratio of each component may fluctuate depending on the part of the plant and its age. The soil's properties, when the plant is harvested, and other factors may also have an impact on the constituents' effectiveness. For instance, it's commonly accepted that the older the root of ginseng, the higher the amount of ginsenosides it contains and the stronger its effects. Lastly, the presence of other herbs may also have an impact on the relative concentrations of each cytokine. The benefits of combining herbs have been documented in very few papers, but the amount of study in this field is growing. Since multiingredient prescriptions are common in Chinese medicine, research into the effects of herbal formulae would be quite beneficial. Lotus extracts exhibit significant antioxidant properties which are crucial for combating oxidative stress in various diseases. [8, 9]

1.2 Key herbs for immune enhancement:

a) Echinacea (*Echinacea purpurea*):

The composite family of Asteraceae, or purple cone flower, is called Echinacea. The perennial herbaceous plant echinacea is primarily found in eastern North America. Both the comprehensive morphological classification and the numerical and statistical technique of the echinacea were presented by McGregor (1968) and Binns et al. (2002). Eleven taxa, two subgenera, and four recognized species with two botanical variants are listed by McGregor and Binns. [10]

Uses:

Echinacea is known for its ability to activate immune cells and promote phagocytosis, effectively stimulating the immune system. It also contains polysaccharides and alkamides, which help reduce inflammation. As an antioxidant, Echinacea protects cells from oxidative damage, contributing to overall cellular health. Additionally, it may help alleviate symptoms of depression and anxiety, offering mood-enhancing benefits. Echinacea also exhibits antibacterial properties, demonstrating effectiveness against microorganisms like *Candida albicans*, further supporting its role in enhancing immune defense. [10]

Role:

Three main processes, which collectively increase leukocyte mobility, are responsible for Echinacea immunostimulant activity: phagocytosis activation, fibroblast stimulation, and respiratory activity enhancement. Echinacea purpurea has been shown in numerous in vivo experiments to activate neutrophils, macrophages, polymorphonuclear leukocytes (PMNs), and natural killer (NK) cells, hence augmenting innate immunity. As a result, Echinacea is useful in the prevention and treatment of a wide range of infections, such as those affecting the respiratory system, wounds, and persistent infections in the pelvis. It is thought that the plant's complex chemical makeup, which includes polysaccharides, glycoproteins, ketoalkenes, alkamides, and derivatives of caffeic acid, is what gives it its immunostimulatory and anti-inflammatory properties. [11]

Benefits:

This compound boosts the activity of natural killer cells and macrophages, two crucial types of immune cells, enhancing the body's defense mechanisms. It also reduces inflammation by modulating inflammatory responses, helping to maintain a balanced immune system. By encouraging the synthesis of cytokines, it further coordinates the immunological response, ensuring effective communication between immune cells. Additionally, it has been shown to decrease the frequency and severity of lung infections, providing respiratory support. Its potent antioxidant properties protect immune cells from oxidative damage, further strengthening the immune system's resilience. [12]

b) Turmeric (*Curcuma longa*):

The major ingredient in turmeric, curcumin, has attracted a lot of interest because of its possible health advantages, especially because it contains anti-inflammatory and antioxidant qualities. These advantages include lowering inflammation, controlling oxidative stress, and promoting cardiovascular and metabolic health. Furthermore well-known for its ability to treat ailments like hyperlipidemia, arthritis, and even mood disorders like anxiety is curcumin. Unfortunately, curcumin's poor bioavailability—it is quickly digested and eliminated from the body—is a significant drawback. To get around this, it has been demonstrated that mixing curcumin with other ingredients, such as piperine from black pepper, significantly increases its bioavailability and improves its

therapeutic effects.^[13]

Uses:

This compound enhances the immune response by activating T-cells and macrophages, key players in the immune system. It also reduces inflammation by lowering the levels of pro-inflammatory cytokines. Additionally, it has anti-cancer properties, as it inhibits tumor growth by preventing the division of cancer cells. Beyond its role in immune regulation, it helps manage autoimmune diseases by controlling immunological responses. Furthermore, it supports gut health by promoting a balanced microbiota and reducing inflammation, contributing to overall well-being.^[14]

Role:

These metabolites are used in a wide range of fields, including animal medicine, scientific research, agriculture, and human therapy. They are extensively employed in numerous fields, including veterinary medicine, scientific research, agriculture, and human therapy. The World Health Organization (WHO) estimates that 80% of people in affluent nations use traditional medicine as a source for potentially dangerous medications made from medicinal plants. According to recent study, curcumin possesses anti-inflammatory and anticancer properties, giving it a new level of potential.^[15]

Benefits:

Curcumin is known for its ability to relieve arthritis symptoms and reduce inflammation, providing significant relief for those with joint pain. It also improves cognitive capacities, thereby enhancing overall brain function. Additionally, curcumin promotes heart health by improving endothelial function, which is crucial for maintaining healthy blood vessels. Its anticancer properties help inhibit the formation of tumors, offering protective benefits against certain types of cancer. Moreover, curcumin aids digestion by alleviating symptoms of indigestion, contributing to better gastrointestinal health.^[16]

c) Garlic (*Allium sativum*):

For millennia, people have been aware of the medical benefits of garlic (*Allium sativum*). Aged Garlic Extract (AGE) stands out among other garlic preparations because of its strong immunomodulatory properties. Garlic's health advantages are mostly attributable to sulfur-containing molecules like S-allyl cysteine, which are made more bioavailable by aging. Through regulating cytokine synthesis, boosting natural killer cell activity, and offering defense against oxidative stress, AGE has been demonstrated to improve immunological function. Because of these qualities, aged garlic extract is a useful natural supplement that promotes overall health and immunological function.^[17]

Uses:

Garlic components help reduce inflammation by blocking cytokines that promote inflammatory responses. They also boost the activity of T-cells and macrophages, strengthening the body's immune defenses. The vasodilatory properties of garlic contribute to lowering blood pressure by relaxing blood vessels. Additionally, garlic has antibacterial qualities that help protect against germs and infections. Its antioxidant properties counteract free radicals, thereby reducing oxidative stress and contributing to overall health.^[18]

Role:

Many studies on the health advantages of garlic and its preparations have been published in only the previous ten years. Garlic is commonly both in the form of drinks and as spices in cuisine. A clove, or sativum bulbs, have historically been employed as apocryphal medical systems, contemporary medications, nutraceuticals, and food supplements, traditional therapies, pharmacological bridges, and chemical components of manufactured medication.^[19]

Benefits:

This compound promotes better blood circulation and lowers cholesterol, thereby improving cardiovascular health. It enhances immune cell activity, which helps to strengthen the immune system. Its antioxidant properties protect cells from oxidative damage, contributing to overall cellular health. By lowering inflammation, it may reduce the risk of developing chronic illnesses. Additionally, it supports general health by aiding the liver in its detoxifying functions, which is crucial for maintaining overall well-being.^[20]

d) Basil (*Ocimum sanctum*):

The herb known as basil, or *Ocimum basilicum*, is well-known in traditional medicine for a variety of medicinal uses. The possible immunomodulatory properties of basil aqueous extract, which involve boosting or modulating the body's immunological responses, have drawn attention. This extract's abundance of bioactive chemicals has been demonstrated to affect different immune cells, which may strengthen the body's defenses. According to

the study, basil has a significant role in immune function modulation and may be useful in preventing and enhancing health.^[21]

Uses:

Basil is known for its ability to improve digestion and relieve stomach pains. It is commonly used to treat respiratory conditions such as asthma and cough. Basil leaves are also utilized as a natural remedy for headaches and migraines. The herb's antibacterial properties make it effective for treating cuts and wounds. Additionally, basil is applied to reduce fever and alleviate symptoms of the common cold, contributing to overall health and comfort.^[22]

Role:

Mahapatra et al. in 2011 examined the immunomodulatory properties of *O. gratissimum* extract as well as the immunological responses and activities in macrophages stimulated with nicotine. An aqueous extract of the plant at a concentration of 10 µg/mL significantly decreased the generation of NO produced by nicotine and the expression of iNOS II. By down regulating Th1 cytokines in macrophages treated with nicotine and concurrently activating Th2 responses, the plant's aqueous extract exhibited protective effects on mouse peritoneal macrophages.^[23]

Benefits:

This compound has notable anti-inflammatory qualities that help reduce inflammation in the body. It employs antioxidants to protect cells from oxidative damage, which supports overall cellular health. Additionally, it encourages a healthy immune system, enhancing the body's ability to fend off illnesses. The compound also combats fungi, bacteria, and viruses, providing a broad spectrum of antimicrobial action. Furthermore, it lowers cholesterol levels, contributing to improved heart health and reducing the risk of cardiovascular diseases.^[24]

e) Ashwagandha (*Withania somnifera*):

Known by many as winter cherry or Indian ginseng, ashwagandha (*Withania somnifera*) is a highly valued plant in traditional Ayurvedic medicine and is well known for its strong immunomodulatory qualities. It has been utilized for ages to lengthen life, increase cerebral and physical toughness, and enhance general wellbeing. The plant is especially well-known for its capacity to influence immunological responses, strengthening the body's defenses against different stresses. Research indicates that the immunomodulatory effect of ashwagandha is mostly attributed to its bioactive components, including withanolides, which makes it a potentially useful natural remedy for enhancing immunity and preserving health.^[25]

Uses:

This compound enhances the activity of immunological cells, strengthening the body's immune defense. It also boosts the production of antibodies, which are crucial for recognizing and neutralizing pathogens. Additionally, it helps diminish inflammation associated with immune responses, contributing to a balanced immune system. By preserving the overall equilibrium of the immune system, it supports effective immune function. Furthermore, it encourages resistance to infections, helping the body fend off various diseases and maintain health.^[26]

Role:

Membranaceous Astragalus Bunge (also known as Astragalus propinquus Schischkin) is a flowering medicinal plant belonging to the Fabaceae (or Leguminosae) family. It has been found to have various health benefits, including hypoglycemia, anti-osteoporosis, anti-fatigue, anti-inflammatory, anti-cancer, antioxidant, and immune system boosting.^[27]

Benefits:

This compound helps balance cortisol levels, thereby reducing stress and anxiety. It promotes the activity of white blood cells, which strengthens the immune system and enhances the body's defense mechanisms. Additionally, it supports cognitive performance through its neuroprotective properties, aiding in mental clarity and focus. Athletes benefit from its ability to assist in muscular growth and recovery, enhancing physical performance and recuperation. Furthermore, it regulates sleep cycles, improving the overall quality of sleep and contributing to better rest and recovery.^[28]

f) Astragalus (*Astragalus membranaceus*)

The plant *Astragalus membranaceus* yields astragalus polysaccharide, which has attracted a lot of interest due to its possible immunomodulatory properties. Traditional Chinese medicine uses astragalus extensively because of its well-known health benefits, including its ability to strengthen the immune system. It is thought that a key factor in these actions is the polysaccharide component of astragalus, a complex carbohydrate with a variety of biological functions. Studies demonstrate that it can regulate immunological responses, which may have therapeutic advantages for a range of illnesses. This review examines the mechanisms of action and immunomodulatory effects

of Astragalus polysaccharide, assessing its effectiveness as a natural immunoenhancer.^[29]

Uses:

Astragalus enhances both the flavor and nutritional content of food, making it a valuable addition to the diet. When used as a dietary supplement, it supports general health and boosts immunological function, contributing to overall well-being. In traditional Chinese medicine, Astragalus is known for promoting longevity and increasing energy levels. Current pharmaceutical research is exploring its potential applications in treating various illnesses, highlighting its therapeutic potential. Additionally, its anti-inflammatory and antioxidant properties further enhance overall health by reducing inflammation and protecting cells from oxidative damage.^[30]

Role:

A number of flavanones were isolated from various Astragalus species, but only two flavanone glycosides from Astragalus corniculatus and Astragalus ponticus were reported. The only Astragalus species known to contain flavanonols is Astragalus sinicus. This plant yielded ampelopsin and its 3'-glucoside and 3'-xyloside. Astragalus adsurgens that were pathogenic-infected contained a new dihydrochalcone derivative called astradurnin along with six known chalcones. The only auron identified from the genus was sulfuretin from Astragalus microcephalus.^[31]

Benefits:

During treatment, this compound strengthens the immune system, enhancing the body's ability to fight off illnesses. It also lowers inflammation caused by diseases, helping to reduce discomfort and promote recovery. Through its antioxidant properties, it offers protection against oxidative stress, which can damage cells and tissues. Additionally, it increases vitality and reduces fatigue, contributing to overall energy levels. It also encourages quicker healing of wounds and faster recuperation, supporting the body's repair processes and improving recovery times.^[32]

REFERENCES:

1. Sultan MT, Buttxs MS, Qayyum MM, Suleria HA. "Immunity: plants as effective mediators. Critical reviews in food science and nutrition", *Journal of Pharma Research* **2014** 1; 54(10):1298-308.
2. Ara I, Maqbool M, Zehravi M, Gani I. "Herbs boosting immunity in Covid-19: an overview", *Adv J Chem B.* **2020**; 3(3):289-94.
3. Gopal Sosa, Dr. Nishkruti Mehta, Dr. Pragnesh Patani, Recent Advancement in Leprosy, *Azerbaijan Medical Journal*, Volume 62, **2022**.
4. Dr. Pragnesh Patani, Dr. Nishkruti Mehta, "Evaluation of antidepressant activity of Picrorrhiza kurroa using baclofen-induced Hypothermia in Mice", *Journal of Emerging Technologies and Innovative Research*, **2019**, 6(6), 326-331.
5. Harsh Chunara, Dr. Nishkruti Mehta, Dr. Pragnesh Patani, "Evaluation of Antimicrobial activity of N-Hexane extract of different parts of pumpkin (Seeds, Leaves, and pulp)", *Journal of Pharma Research*, **2019**, 8(3), 72-75.
6. Debnath S, Chakravorty R, Devi D. "A Review on Role of Medicinal plants in Immune system". *Asian Journal of Pharmacy and Technology*. **2020**; 10(4):273-7.
7. Nishkruti Mehta, Dr. Indrajeet Singhvi, Dr. Pragnesh Patani, "A review on tomato lycopene", *International Journal of Pharmaceutical Science and Research*, **2018**, 9(3): 916-923
8. Tan BK, Vanitha J. "Immunomodulatory and antimicrobial effects of some traditional Chinese medicinal herbs: a review." *Journal of Current medicinal chemistry*. **2004** June 1; 11(11):1423-30.
9. Nishkruti Mehta, Ekta Patel, and Pragnesh Patani, "Nelumbo Nucifera (Lotus): A Review on Ethnobotany, Phytochemistry, and Pharmacology", *Indian Journal of Pharmaceutical and Biological Research*, **2013**, 1(4):152-167.
10. Kumar KM, Ramaiah S. "Pharmacological importance of Echinacea purpurea". *International Journal of Pharma and Bio Sciences*. **2011**; 2(4):304-14.
11. Manayi A, Vazirian M, Saeidnia S. "Echinacea purpurea: Pharmacology, phytochemistry and analysis methods". *Journal of pharmacognosy reviews*. **2015**; 9(17):63.
12. Abbas M, Mahmoud A, Sharoud M. "Potential immunological benefits of Echinacea". *J. Radiat. Res. Appl. Sci.* **2009**; 2:1078-90.
13. Hewlings SJ, Kalman DS. "Curcumin: A review of its effects on human health". *Journal of foods and medicine*. **2017**; 6(10):92.
14. Srivastava RM, Singh S, Dubey SK, Misra K, Khar A. "Immunomodulatory and therapeutic activity of curcumin". *International journal of immunopharmacology*. **2011**; 11(3):331-41.
15. Chanda S, Ramachandra TV. "Phytochemical and pharmacological importance of turmeric (Curcuma longa): A review". *Research & Reviews: A Journal of Pharmacology*. **2019**; 9(1):16-23.
16. Rathore S, Mukim M, Sharma P, Devi S, Nagar JC, Khalid M. "Curcumin: A review for health benefits". *Int. J. Res.*

- Rev. **2020**; 7(1):273-90.
17. Kyo E, Uda N, Kasuga S, Itakura Y. "Immunomodulatory effects of aged garlic extract". *The Journal of nutrition*. **2001**; 131(3):1075S-9S.
18. Arreola R, Quintero-Fabián S, López-Roa RI, Flores-Gutiérrez EO, Reyes-Grajeda JP, Carrera-Quintanar L, Ortuño-Sahagún D. and "anti-inflammatory effects of garlic compounds". *Journal of immunology research*. **2015**(1):401630.
19. Divya BJ, Suman B, Venkataswamy M, Thyagaraju K. "A study on phytochemicals, functional groups and mineral composition of *Allium sativum* (garlic) cloves". *Int J Curr Pharm Res*. **2017**; 9(3):42-5.
20. Ryu JH, Kang D. "Physicochemical properties, biological activity, health benefits, and general limitations of aged black garlic: A review". *Journal of molecules*. **2017**; 22(6):919.
21. Tsai KD, Lin BR, Perng DS, Wei JC, Yu YW, Cherng JM. "Immunomodulatory effects of aqueous extract of *Ocimum basilicum* (Linn.) and some of its constituents on human immune cells". *Journal of Medicinal Plants Research*. **2011** 18; 5(10):1873-83.
22. Egata DF. "Benefit and use of sweet basil (*Ocimum basilicum* L.) in Ethiopia: A review". *J. Nutr. Food Process*. **2021**; 4(5):57-9.
23. Ugbogu OC, Emmanuel O, Agi GO, Ibe C, Ekweogu CN, Ude VC, Uche ME, Nnanna RO, and Ugbogu EA. A review on the traditional uses, phytochemistry, and pharmacological activities of clove basil (*Ocimum gratissimum* L.)". *Journal of heliyon*. **2021**; 7(11).
24. Singletary KW. "Basil: A brief summary of potential health benefits". *Nutrition today*. **2018**; 53(2):92-7.
25. Ziauddin M, Phansalkar N, Patki P, Diwanay S, Patwardhan B. "Studies on the immunomodulatory effects of Ashwagandha". *Journal of ethnopharmacology*. **1996**; 50(2):69-76.
26. Agarwal R, Diwanay S, Patki P, Patwardhan B. "Studies on immunomodulatory activity of *Withania somnifera* (Ashwagandha) extracts in experimental immune inflammation". *Journal of Ethnopharmacology*. **1999**; 67(1):27-35.
27. Sangwan RS, Chaurasiya ND, Misra LN, Lal P, Uniyal GC, Sharma R, Sangwan NS, Suri KA, Qazi GN, Tuli RJ. "Phytochemical variability in commercial herbal products and preparations of *Withania somnifera* (Ashwagandha)". *Journal of current science*. **2004** 10:461-5.
28. Mahato U, Sharma D. "Ashwagandha extraction and its health benefits". *International Journal of Herbal Medicine*. **2022**; 10(4):22-31.
29. Li CX, Liu Y, Zhang YZ, Li JC, Lai J. "Astragalus polysaccharide: a review of its immunomodulatory effect". *Journal of archives of pharmacal research*. **2022**; 45(6):367-89.
30. Shahrajabian MH, Sun W, Cheng Q. "A Review of Astragalus Species as Foodstuffs, Dietary Supplements, a Traditional Chinese Medicine and a Part of Modern Pharmaceutical Science". *Journal of applied ecology & environmental research*. **2019** 1; 17(6).
31. Bratkov VM, Shkondrov AM, Zdraveva PK, Krasteva IN. "Flavonoids from the genus *Astragalus*: phytochemistry and biological activity". *Journal of pharmacognosy reviews*. **2016**; 10(19):11.
32. Ny V, Houška M, Pavela R, Tříška J. "Potential benefits of incorporating *Astragalus membranaceus* into the diet of people undergoing disease treatment: An overview". *Journal of Functional Foods*. **2021**; 77:104339.1.