

Herbal Immunity Boosters: Scientific Perspective

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Abstract

The growing interest in complementary and alternative therapies in recent years can be linked to the growing popularity of herbal medications for boosting immunity. This review aims to provide a comprehensive analysis of the scientific perspectives on herbal immune boosters, outlining their possible benefits, disadvantages, and prospects for the future. We examine the literature on various herbs, including ginseng, ashwagandha, turmeric, and echinacea, in strengthening the immune system and reducing the risk of illness. Although these herbs exhibit immense potential, literature review shows that the available data is frequently unreliable and limited by methodological issues. Further investigation is necessary to fully understand how these herbs affect human immunity as well as to ascertain their efficacy and safety. The scientific basis of herbal immune boosters is well explained in this article, which is a great tool for researchers, medical professionals, and anybody else interested in learning more.

Keywords: Ayurveda, Immunity, Herbs, Immunity boosters,

Introduction

To protect the body from diseases and infections, the immune system is essential. There is increasing interest in looking into complementary and alternative medicines to improve immunity as the number of immune-related illnesses rises. Herbal treatments have long been used in traditional medicine to strengthen the immune system and prevent illness. Due to the

limitations of traditional treatments and the growing awareness of the importance of immune health, there has been a recent surge in interest in herbal immunity boosters.

The idea that certain herbs can stimulate the immune system and increase its ability to fight off infections and diseases is the foundation of the practice of employing herbal treatments to boost immunity. Many herbs, including turmeric, ginseng, ashwagandha, and echinacea, have long been used for their immune-boosting properties. Numerous bioactive substances found in these herbs have the ability to affect immunological response, reduce inflammation, and increase antioxidant activity.

Even while natural immunity boosters are becoming more and more popular, scientific proof of their efficacy and safety is desperately needed. Herbal treatments' effects on immunological function have been the subject of several studies, although the results are usually conflicting and limited by methodological flaws. This review aims to provide a comprehensive analysis of the scientific perspectives on herbal immune boosters, outlining their possible benefits, disadvantages, and prospects for the future.

The immune system is a complex network of cells, tissues, and organs that work together to defend the body against infections and diseases. There are two main types of immune systems:

1. Innate immune system

The innate immune system, the body's natural defense mechanism, serves as the initial line of protection against infections and is unable to distinguish between different types of viruses. It consists of: [Yates, W. (2014). *Lecture 1 – Innate Immune System*. Honors Human Physiology (NROSCI/BIOSC 1070 and MSNBIO 2070). University of Pittsburgh.]

- **Physical Barriers:** The skin and mucous membranes serve as protective barriers, preventing pathogens from entering the body.

- Phagocytic Cells: Neutrophils and macrophages engulf and kill pathogens.
- Inflammatory Response: Chemical signals are released, causing blood vessels to dilate and bring immune cells to the site of infection.

2. Adaptive immune system

The adaptive immune system is specific, meaning it recognizes and targets specific pathogens. This includes: [Makaju, H. S. (2021, March 18). *Adaptive immunity* [PowerPoint slides]. SlideShare]

- Antigen Presentation: Antigens are processed and presented to T cells by antigen-presenting cells (APCs).
- T Cell Activation: T cells recognise antigens and become activated to kill infected cells or produce chemical signals that activate other immune cells.
- B Cell Activation: B cells antigens and produce antibodies to neutralise pathogens.

The immune system performs different functions [Cleveland Clinic. (n.d.). *Immune system function, conditions & disorders*. Cleveland Clinic] such as

1. Pathogen recognition: Identifying and recognizing pathogens
2. Activation of immune cells: Activating immune cells to fight infections
3. Elimination of pathogens: Eliminating pathogens from the body
4. Immunological memory: Retaining memory of specific pathogens to provide long-term immunity

Importance of Immune System

The immune system is vital in protecting the body from infections, diseases, and any foreign substances that may enter. Its importance cannot be overstated:

1. Pathogen defence: the immune system identifies and destroys pathogens, including bacteria, viruses, and fungi, to prevent infections.
2. Disease prevention: The body needs a robust immune system to guard against a variety of diseases, including as cancer, autoimmune disorders, and chronic illnesses.
3. Overall health: The immune system is essential for maintaining general health and wellbeing.

We can better understand the value of a strong immune system and take preventative action to ensure its peak performance by being aware of the many kinds of immune systems and their functions.

Mechanism of Immune System Activation

Numerous complex mechanisms involving various cells and chemicals activate the immune system. This is a thorough explanation of the procedure:

1. Pathogen Recognition: Immune cells, including dendritic cells and macrophages, are able to identify pathogens through the presence of PRRs. [Murphy, K. M. (2006). The adaptive immune system. *Cell*, 124(4), 631–640]
2. Antigen Processing: antigen-presenting cells (APCs) break down antigens and offer them to T cells. [Sharda, R. (n.d.). *Antigen processing and presentation* [Lecture notes]. Department of Veterinary Microbiology, NDVSU College of Veterinary Science & A.H., Mhow].
3. Activation of T cells: T cells recognize antigens and either produce chemical signals or start the death of sick cells. [Humphrey, J. H., & Perdue, S. S. (n.d.). *Activation of T and B lymphocytes*. In *Encyclopædia Britannica*]
4. Cytokine Production: Immune cells that are activated release cytokines that attract other immune cells to the site of infection. [Miller, F. P. (n.d.). *Chapter 13: Cytokines* [Lecture notes]. Northern Arizona University]
5. Effector Functions: Effector actions, like destroying infected cells or producing antibodies, are performed by activated immune cells. Janeway, C. A., Jr., Travers, P., Walport, M., & Shlomchik, M. J. (2001). General properties of armed effector T cells. In *Immunobiology: The immune system in health and disease* (5th ed.). Garland Science

Herbal Immunity Boosters

Literature has revealed that herbal plants play a prominent role as immunomodulatory agents. It is seen that the immune boosting potential of plants is majorly because of the presence of secondary metabolites.

Ashwagandha: Utilising its active ingredients such as flavonoids, glycosides (sitoinosides), the natural herb ashwagandha strengthens the body's defences.

These compounds increase the function of the immune system by boosting the production of antibodies, stimulating natural killer cells lowering oxidative stress and inflammation. Regular ashwagandha consumption can fortify the immune system, offering defense against illnesses and infections.

Tulsi: Holy basil, or tulsi, is a herb that boosts immunity and contains both ursolic acid, eugenol, Rosmarinic acid and flavonoids such as vicenin and orientin. These compounds

increase the function of the immune system by stimulating the generation of antibodies stimulating immune cells (t-cells, macrophages) lowering oxidative stress and inflammation. Because of its capacity to regulate the immune system, tulsi promotes general health and wellness by protecting against illnesses, allergies, and infections. Your immune system can be supported by include tulsi tea or supplements in your regular routine.

Turmeric: Curcuminoids, volatile oils, and other bioactive substances (Curcumin (polyphenol), Volatile oils (atlantone, turmerone) are found in turmeric, a spice with immunomodulatory qualities. Curcumin enhances the immune system by stimulating the generation of antibodies, stimulating immune cells (t-cells, macrophages) lowering oxidative stress and inflammation. The immune-boosting properties of turmeric help protect against allergies, illnesses, and infections. The potent anti-inflammatory and antioxidant qualities of curcumin support general health and well-being. Adding turmeric to meals, taking it as a tea, or taking it as a supplement can help strengthen the immune system.

Amla: Amla, sometimes referred to as Indian gooseberry, is a fruit rich in nutrients and immune stimulating ingredients are tannins, vitamin C, Flavonoids and Emblicanin. These compounds increase the function of the immune system by promoting the formation of antibodies, lowering inflammation and oxidative stress - stimulating immune cells (t-cells, macrophages). Amla protects against allergies, illnesses, and infections by regulating the immune system. You can strengthen your immune system and improve your general health and well-being by include amla juice, powder, or supplements in your diet.

Giloy: Alkaloids, flavonoids, terpenes, and phenolic chemicals are among the secondary metabolites found in giloy (*Tinospora cordifolia*). These compounds increase resistance through their ability to eliminate free radicals via antioxidant activity. Modifying the immune response, lowering inflammation, controlling the immune system's reaction to infections and preventing the growth of microorganisms. Giloy is a useful herb in traditional medicine for increasing immunity and enhancing general health because of these qualities. It is a popular component of ayurvedic treatments for immune system support and illness prevention because of its secondary metabolites, which work together to improve immunological function. Regular eating can enhance general health.

Ginger: Secondary metabolites found in ginger (*Zingiber officinale*) include gingerols, which are strong substances with antioxidant and anti-inflammatory properties. When gingerols are dried or heated, they produce shogaols, which have anti-inflammatory and anti-cancer qualities. Paradols are substances that have anti-inflammatory and antioxidant properties. By lowering oxidative stress and inflammation, regulating the immunological response, demonstrating antibacterial action, and strengthening antioxidant defenses, these secondary metabolites improve immunity. Ginger is frequently used in traditional medicine to prevent illnesses and preserve general health because of its immune-boosting active ingredients. Its ability to strengthen the immune system can help protect against illnesses and infections. Regular eating has been shown to increase happiness.

Shatavari: *Asparagus racemosus*, or shatavari, includes secondary metabolites such as Saponins are substances that have antioxidant and immunomodulatory properties. Flavonoids are antioxidants that lessen oxidative stress and inflammation. Polyphenols are substances that have anti-inflammatory and antioxidant qualities. By improving immune cell function, decreasing oxidative stress and inflammation, regulating the immunological response, and promoting general health and wellbeing, these secondary metabolites improve immunity being Ayurvedic medicine benefits greatly from shatavari's active components, particularly when it comes to strengthening the immune system.

Ginseng: Secondary metabolites found in ginseng (*panax ginseng*) include Ginsenosides (triterpene) saponins that have immunomodulatory, antioxidant, and anti-inflammatory properties. Polysaccharides are substances that boost the immune response and activate immune cells. By increasing cytokine synthesis and immune cell activity, these secondary metabolites improve immunity. Lowering oxidative stress and inflammation, adjusting the immune system's reaction to infections and improving the immune system as a whole because of its immune-boosting properties, ginseng is frequently used in traditional medicine to increase vitality.

Brahmi: Secondary metabolites found in Brahmi (*Bacopa monnieri*) are Bacosides (triterpenoid) saponins that have immune-boosting and neuroprotective properties. Flavonoids are substances that have anti-inflammatory and antioxidant qualities. Saponins are substances that have adaptogenic and immunomodulatory properties. These secondary metabolites improve antioxidant defenses, which in turn boost immunity. Lowering oxidative stress and inflammation, regulating the immune system, enhancing stress tolerance and cognitive function because of its immune-boosting properties, brahmi is a popular herb in ayurveda medicine for enhancing memory, cognitive function, and general well-being. It strengthens the immune system.

Triphala: Secondary metabolites found in triphala, a blend of three plants (amalaki, haritaki, and bibhitaki), include Amalaki (Indian gooseberry) contains potent antioxidants called anthocyanins, tannins (haritaki and bibhitaki) contain antibacterial and anti-inflammatory substances. All three herbs contain flavonoids, which are anti-inflammatory and antioxidant substances. By lowering oxidative stress and neutralizing free radicals, as well as by having antibacterial and anti-inflammatory properties, these secondary metabolites improve immunity. Strengthening antioxidant defenses promoting immune system and gastrointestinal health. The balanced blend of bioactive substances in triphala strengthens the immune system and promotes general health and wellbeing. For centuries, herbal plants have been employed in traditional medicine to boost cognitive functions and improve overall health. Table 1 shows some plants with immunomodulatory properties mentioned in the literature.

Table 1. Herbals with immunomodulatory properties

Sr. no	Plant Name	Biological Source	Uses	Mechanism Of Action	Reference
1.	Ashwagandha	Withania somnifera (L.) Family: Solanaceae	stress-lowering energy-boosting, and immune-balancing	Withanolides Act on the Hypothalamic pituitary-adrenal axis to reduce stress and anxiety.	Yadav, R., & Patel, D. (2022). A review article on Ashwagandha (<i>Withania somnifera</i>) The natural immunity booster. <i>International Journal of Research Publication and Reviews</i> , 3(11), 1351–1354.
2.	Tulsi	Ocimum sanctum Family: Lamiaceae	immunity, Respiratory disease Diabetes, antioxidant, treatment of asthma	Increases natural killer (NK) cells, T-cells, and B-cells, all of which aid the body in battling infections. Tulsi decreases those that lead to excessive inflammation (like IL-4, IL-6, and IL-10) and raises beneficial ones (like IL-2 and IFN- γ). This Aids in the body's IgG and IgM antibody production. Tulsi contains potent Antioxidants that shield immune cells from such as rosmarinic acid and eugenol	Newman, D. J., & Cragg, G. M. (2011). Natural products as sources of new drugs over the 30 years from 1981 to 2010. <i>Journal of Natural Products</i> , 75(3), 311–335.
3.	Turmeric	Curcuma longa Family: Zingiberaceae	Anti-inflammatory, Spice in cooking, Hyperlipidemia, Immune health	increases T-cells, B-cells, NK cells, and macrophages, Among other immune cells. By inhibiting important Inflammatory molecules like TNF- α , curcumin decreases Detrimental inflammation. IL-1 β and IL-6 shield immune cells from harm. Maintains an appropriate ratio of cytokines that promote and inhibit inflammation. Encourages a healthy, balanced immune system that isn't hyperactive.	Shree, P., Mishra, P., Selvaraj, C., Singh, S. K., Chaube, R., Garg, N., & Tripathi, Y. B. (2021). Targeting COVID-19 (SARS-CoV-2) Main protease through active phytochemicals: An in silico approach for drug development. <i>Frontiers in Pharmacology</i> , 12, 643119.
4.	Amla	Emblica officinalis Family: Phyllanthaceae	Boosts Immunity, Diabetes, Heart health, Aiding weight Management antioxidant	It contains Vitamin C Enhances Production of White blood cells (WBCs) Stimulates T-Cells and macrophages. Vitamin C and other antioxidants help fight free radicals that can weaken immune cells. Amla helps Keep the immune system from being too Weak or too overactive	Kumar, S., & Sharma, P. (2023). A review On immunomodulatory effects of <i>Withania somnifera</i> (Ashwagandha). <i>Global Journal of Research on Medicinal Plants & Indigenous Medicine</i> , 24(2), 115–120.

5.	Giloy	Tinospora cordifolia Family: Menispermaceae	Boosts Immunity, Improves Digestion, Detoxifies the Body, Manages Diabetes	Main Active Compounds in Giloy which help in immune health are Alkaloids, glycosides, diterpenoids, and polysaccharides. Giloy stimulates the immune system by activating macrophages, natural killer (NK) cells, and cytokine production (like IL-6, IL-1, and TNF- α). Inhibits COX-2 enzyme and pro-inflammatory cytokines, reducing inflammation. Fights free radicals that can damage immune cells. Supports long-term immune health and prevents early Aging of immune cells.	Sutar, R. S., & Sutar, P.P. (2024). Herbal immunity boosters: A comprehensive review. <i>Heliyon</i> , 10(4), e27994
6.	Ginger	Zingiber officinale Family: Zingiberaceae	Digestive Aid, Immunomodulatory, Cardioprotective, Antidiabetic, Antioxidant, Respiratory Relief,	Inhibits COX-1, COX-2, and 5-lipoxygenase (5-LOX) enzymes, which result in reduction of the production of prostaglandins and leukotrienes which are the major inflammatory mediators. Then it acts by enhancing antioxidant defences which modulates the immune cells such as T cells.	Khan, S., & Ali, A. (2023). Immune Response. In <i>StatPearls</i> . StatPearls Publishing.
7.	Shatavari	Asparagus racemosus Family: Asparagaceae	improvement in reproduction, anti-anxiety effects, boosts immune system	Its key constituents like shatavarins, flavonoids, and polysaccharides are responsible for the immunomodulatory effect. They boost antibody production and T-cell response, which increases phagocytosis and cytokine release, which balances Th1/Th2 responses for appropriate immune reaction, which results in protecting the immune cells.	Block, K. I., & Mead, M.N. (2003). Immune system effects of Echinacea, ginseng, and astragalus: A review. <i>Journal of Ethnopharmacology</i> , 85(1), 37–41.
8.	Ginseng	Panax ginseng Family: Araliaceae	It regulates blood sugar, builds immunity, reduces inflammation	activity of macrophages, T cells, B cells, which regulates levels of IL-1, IL-6, IFN- γ , and TNF- α , balancing pro- and anti-inflammatory responses. It supports humoral immunity. The main active compounds (e.g., Rg1, Rb1) exert direct effects on immune signalling pathways, which protect immune cells from oxidative damage and excessive inflammation.	Song, J., Choi, J., & Kim, B. (2013). Anti-inflammatory and immunomodulatory effects of ginseng. <i>Journal of Ginseng Research</i> , 37(1), 1-6
9.	Brahmi	Bacopa monnieri Family: Plantaginaceae	It regulates blood sugar, builds immunity, treats anxiety disorder, improves cognitive function	Brahmi exhibits immunomodulatory activity through stimulation of immune cell activity, in which there is enhancement of macrophage function, lymphocyte proliferation. It also releases IL-2, IL-6, which regulates immune response.	Block, K.I., Mead, M. N., & Guarneri, E. (2003). Immune system effects of Echinacea, ginseng, and astragalus: A review. <i>Journal of Ethnopharmacology</i> , 137(1), 1–12.

10.	Triphala	Haritaki - Terminalia chebula (Combretaceae.) Bhibhtaki - Terminalia bellirica (Combretaceae.) Amalaki - Phyllanthus emblica (Family: Phyllanthaceae)	Reduction of hyperacidity, antioxidant, anti-inflammatory, immunomodulating, antibacterial, act as natural laxative	Triphala is a blend of Amalaki, Bibhitaki and Haritaki which modulates immune system through enhancement of macrophage activity by increasing phagocytosis and innate immune response. It also boosts lymphocyte function by promoting T-cells and B-cells.	Srikumar, R., Parthasarathy, N. J., Manikandan, S., Narayanan, H. V., & Sheela Devi, R. (2024). Immunomodulatory effects of Triphala and its individual constituents: A review. <i>Journal of Pharmacology and Therapeutics</i> , 28(4), 259–266.
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Table 2. Some marketed herbal immune boosting products

Sr.no	Companies	Marketed products	Challenges	Reference
1.	Dabur Ltd.	Dabur Chyawanprash, Dabur Amla	Herbal goods are mostly Made of natural substances, but the quality of these ingredients varies widely depending on where they are sourced from. Depending on the season and the area, unusual herbs and natural raw materials may not always be readily available. Additional pressure is created by transportation issues, the need to accommodate dietary variations like veganism, and the demand for organic food.	Upstox News Desk. (2024, August 5). <i>Key lessons from Dabur India's turnaround story</i> . Upstox.
2.	Patanjali Ayurved Limited	Patanjali Ashwagandha Capsules, Patanjali Divya Coronil Kit	Patanjali's rapid expansion was a result of its fast growth, as it introduced numerous products within a short period of time. The company encountered numerous accusations and reports regarding the production of subpar products or the failure of quality tests in the sourcing of raw materials for international expansion.	Arayans, S. (2024, September 26). <i>The journey and challenges of Patanjali: Patanjali case study</i> . SachinThakur.in.
3.	Himalaya Wellness Company	Liv 52, Himalaya Ashwagandha Tablets	Availability of raw materials dependent on the season. The combination of traditional Ayurvedic practices and modern scientific methods requires significant resources and time. Comparing the level of complexity in cross-category manufacturing and its impact on the competitive landscape.	Author(s). (Year). <i>A study on Marketing strategies and SWOC analysis of Himalaya Wellness Private Ltd.</i> ResearchGate.
4.	Emami Group of Companies Pvt Ltd	Baidyanath Chyawanprash, Zandu Aloe Vera +5 Herbs Juice	Like other businesses with an ayurvedic focus, Emami uses natural substances, oils, and herbs (such as menthol, camphor, and ayurvedic oils). Managing a variety of product lines requires expert staff and specialized equipment.	Our Wealth Insights. (n.d.). <i>Emami Ltd: Analysis of the business fundamentals</i> . Our Wealth Insights. Retrieved April 21, 2025,

How a lifestyle shift towards a holistic herbal approach can help?

The herbal immunity boosters are not just popular for avoiding illness, but they could reflect a larger moment if taken appropriately. People are recognizing the importance of nurturing health daily rather than relying solely on pharmaceuticals once sickness strikes.

This shift is being accelerated by a number of social trends. Firstly, there's the clean living movement, where consumers are increasingly reading labels and choosing natural alternatives. Secondly, the rise of mindfulness, yoga, and plant-based diets is fostering an environment where herbal wellness is embraced. Thirdly, the COVID-19 pandemic acted as a global wake-up call, emphasising the importance of immune resilience and leading many to explore natural solutions for staying well.

Incorporating herbs into one's lifestyle has become relatively simple. Herbal teas, tinctures, supplements, and even culinary additions like fresh ginger or turmeric in meals are now readily available. Companies have capitalised on the trend, offering ready-to-use formulations, immunity shots, herbal mummies, and more. But a wise choice is needed because not all that glitter is gold!

Challenges in the Herbal medicine landscape

Despite all of the challenges, there are certain challenges as well that herbal immunity boosters face. Some rooted in science, others in regulation, and in perception as well. One significant problem is standardisation. The capability of one herb can vary dramatically based on how they are grown, harvested and processed. Unlike pharmaceutical drugs, which have consistent dosages and rigorous testing, herbal products often lack uniformity. This inconsistency can affect both efficacy and safety.

Another issue is regulation. In many countries, herbs are provided as dietary supplements and not as medicines. It means they are not subjected to the same strict approval processes. As a result, the market is flooded with products of varying quality. Adulteration, contamination with heavy metals, and incorrect labelling are all real risks. Consumers must be vigilant, opting for trusted brands and looking for third-party testing certifications.

Another potential challenge could be interactions with medications. Any natural product is presumed to be harmless, which is not true. For example, liquorice root can raise blood pressure when consumed in large amounts. Garlic can thin the blood and should be avoided before surgery. St. John's Wort, while useful for depression, can reduce the effectiveness of birth control pills and other medications. Therefore, consultation with a healthcare provider before beginning any herbal regimen is strongly advised.

Lack of education is the last but one of the biggest challenges. Many people are unaware of which herbs suit their body constitution or current health condition. This can lead to misuse, overuse, or disappointment when results don't align with expectations.

Conclusion

What we are witnessing today is not merely a trend, but a reconnection with centuries-old wisdom that aligns beautifully with contemporary science. Herbs have always been with us—growing in backyards, forests, and mountains, waiting to be rediscovered.

Sipping through a warm cup of ginger tulsi tea or taking an ashwagandha supplement to cope with stress, the integration of natural herbs in modern life represents the lost bridge between tradition and modernisation. With continued research, thoughtful regulation, and global cooperation, herbal medicine has the potential not only to fortify individual immune systems but to build a more resilient, healthy world.

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