

Utilizing phytopharmaceuticals to rejuvenate the immune system: An exciting prospect in India



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Abstract

This review's objective was to compile the significant Phytopharmaceuticals with strong immunomodulatory properties that are confined to consuming in our daily life. The word "Phytopharmaceutical" is derived from the Greek roots "Phyton" (plant) and "Pharmakon" (medicine). It also discussed the function of natural products in the boosting up of immune system to combat many diseases and disorders. For a variety of chronic conditions, including cardiovascular, renal, and autoimmune diseases, these phytomedicines made from the roots, stem, tuber, flower, seed, and leaves were found to possess medicinal properties. In this significant harmony, a compromise or overreaction might have devastating consequences, including autoimmune, immunodeficiency-related, or inflammatory disorders. Conversely, immunological competency may be significantly influenced by nutrition. As prevention is better than cure, it is always acceptable to include such medicinal plants which are easy to ingest and get benefit in terms of being healthier and devoid of ailments.

Keywords: Phytopharmaceuticals, immune system, Indian system of Medicine, Spices

1. Introduction

Phytopharmaceuticals derived from the natural sources are used for diagnosis, prevention and treatment of diseases in animals and humans, both externally and internally but not for parenteral use as per Drugs and Cosmetics Act, 1945, as specified in Rule 2 (1). Phytopharmaceuticals are derivatives of plants with immense pharmacological potential. From decades, plants have been crucial in the Indian ancient medicinal system. These are easily accessible and also have no side effects. As the adverse drug reactions stands as a major concern for public health, can be avoided by substituting synthetic drugs with plant-based medicines (2). This writeup mainly focused on such type of phytopharmaceuticals which are included as food in our daily life. This is because of easy consumption and human compliance.

2. Noteworthiness of immune system

Immune system protects the body from various pathogens such as bacteria's, viruses and fungi. Once our body get expose to any microorganism or antigen, body's immune system gets activated and prevent our body from antigens by eliminating from the body (Figure 1). On the contrary, overactive immune system can cause development of auto-immune disorders such as psoriasis, myasthenia gravis and so on. For achieving a good immunity, it is necessary to take adequate number of vitamins and minerals. Phytopharmaceuticals and its constituents can play a role in providing adequate nutrition to a person.

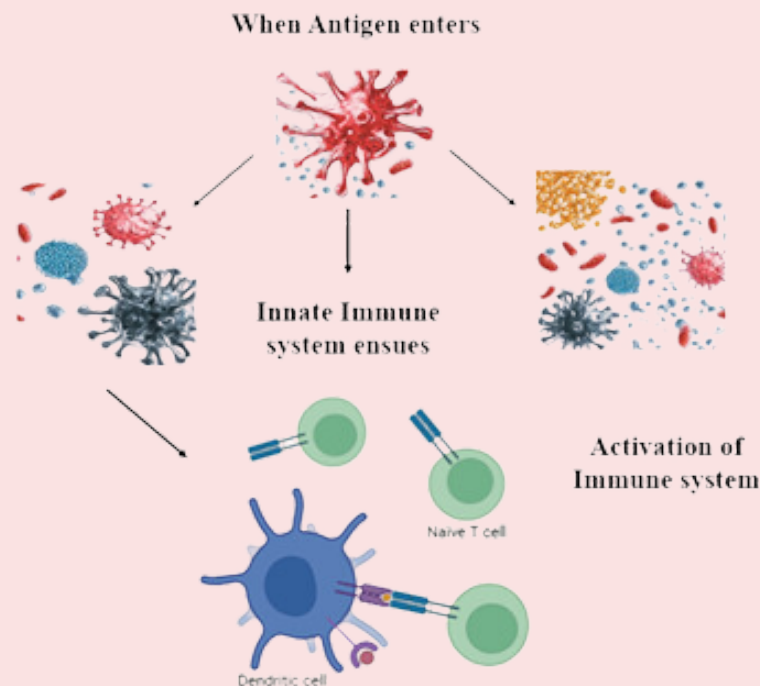


Figure 1. Activation of Immune system with an entry of antigen

3. Phytoactive constituents as immune system boosters

These are essential components of Phytopharmaceuticals, which are extracted from medicinal plants. Phyto active compounds can be flavonoids, terpenoids, carotenoids and polyphenols etc. These compounds have antioxidant properties which can be useful for treating plethora of immune diseases by boosting up the immunity. It is an ideal way to consume herbs, spices and vegetables as a part of our daily diet to improve immunity and prevent from immunodeficiency disorders (3). Phyto active compounds of various Indian medicinal plants are listed in Table 1.

Table 1. Various Indian medicinal herbs and spices with their phytoactive constituents

Common name	Scientific name	Phyto active constituents	Ref
Turmeric	<i>Curcuma longa</i>	Curcumin	4
Cinnamon	<i>Cinnamomum zeylanicum</i>	Cinnamaldehyde and trans-cinnamaldehyde (Cin)	5
Ginger	<i>Zingiber officinale</i>	Gingerols, shogaol, & paradols	6
Garlic	<i>Allium sativum</i>	D-Linalool, Methyl chavicol, eugenol cineole, Allyl sulfides, allicin, ajoene, S-allyl-L-cysteine (SAC)	7
Black pepper	<i>Piper nigrum L</i>	β -pinene, piperine, oleoresins, piperolein, limonene, lignans, alkaloids, flavonoids, myristic acid, myristicin, citral, palmitic acid, piperine, and lauric acid	7

Fenugreek	<i>Trigonella foenum graecum</i>	Pigenin, kaempferol, quercetin, vitexin, tricrin, saponins, naringenin, Sesquiterpenes, aromatic aldehydes, terpenes,	7
Cloves	<i>Syzygium aromaticum</i>	Eugenol, caryophyllene, dehydroeugenol sesquiterpenes, tannins, isoeugenol acetyeugenol pinene, vanillin, flavonoids, phenolic acids, gallic acid	7
Tulsi	<i>Ocimum basilicum L</i>	Catechins, quercetin, rutin, kaempferol, anthocyanins, limonene, terpinene, carvacrol, geraniol, menthol, safrole, tannins, ursolic, p-coumaric, and rosmarinic acids and D-linalool, methyl chavicol, eugenol cineole, and apigenin	7
Amla	<i>Embllica officinalis</i>	Tannins, flavonoids, polyphenols, amino acids, fixed oils and vitamins	8
Neem	<i>Azadirachta indica</i>	Flavonoids, polyphenolic compounds, Quercetin, nimbin, nimbidin nimbolide, ascorbic acid	9
Drum stick	<i>Moringa oleifera</i>	Carotenoids, glucosinolates, flavonoids, tocopherols, and phenolic acids polyunsaturated fatty acids and folate	10
Black seeds	<i>Nigella sativa</i>	Coumarins, γ -terpinene, safranal, quercetin, p-coumaric, rosmarinic, trans-2, dihydrocinnamic acids flavonoids	7
Oregano	<i>Origamum vulgare L</i>	Thymol, carvacrol, α - β -caryophyllene, carnosic acid, carnosol, caffeic acid, rosmarinic acid, flavonoids	7

Various Phytopharmaceuticals (structures shown in Figure 2) which are commonly found in Indian herbs, spices and daily vegetables are as follows (11):

- 3.1. Resveratrol:** It is considerably found in grapes, peanuts, mulberries, blueberries, strawberries. They have antioxidant, anti-aging and anti-carcinogenic properties.
- 3.2. Probiotics and prebiotics:** Probiotics are found in fermented foods and also be taken through supplements. Prebiotics are found in soybeans, greens, banana, garlic onions etc.
- 3.3. Phytosterols:** It is generally found in vegetable oils, fruits, nuts and legumes. They have significant effect on lowering LDL.
- 3.4. Isoflavonoids:** These are present in soybeans, soy cheese, and tofu. They prevent osteoporosis and cancer.
- 3.5. Flavonoids:** Generally found in berries, legumes, tea, grapes, cocoa, spices, fruits, green vegetables, onion, apple, olive oil, walnuts and peanuts. They have antioxidant, antimicrobial and anti-inflammatory properties.
- 3.6. Carotenoids:** They are carotenoids are α -carotene, β -carotene, zeaxanthin, lutein, and lycopene. They are present in color foods carrot, tomato, lettuce, broccoli, squash, red pepper etc. They have anti-oxidant property and protects against various cancers.
- 3.7. Omega-3 fatty acids:** Fishes are main source of omega-3 fatty acids, specially, salmon, mackerel, herring, rainbow trout, and sardines. 18-carbon omega-3 fatty acid, alpha linolenic acid are found in soybean, canola and flax seed oil.
- 3.8. Lycopene:** specifically present in tomatoes and prevent against cardiovascular diseases and cancers.
- 3.9. Anthocyanins:** Red cabbage, cherry, blueberry, and cranberry. They help in preventing hyperlipidemia and diabetes.

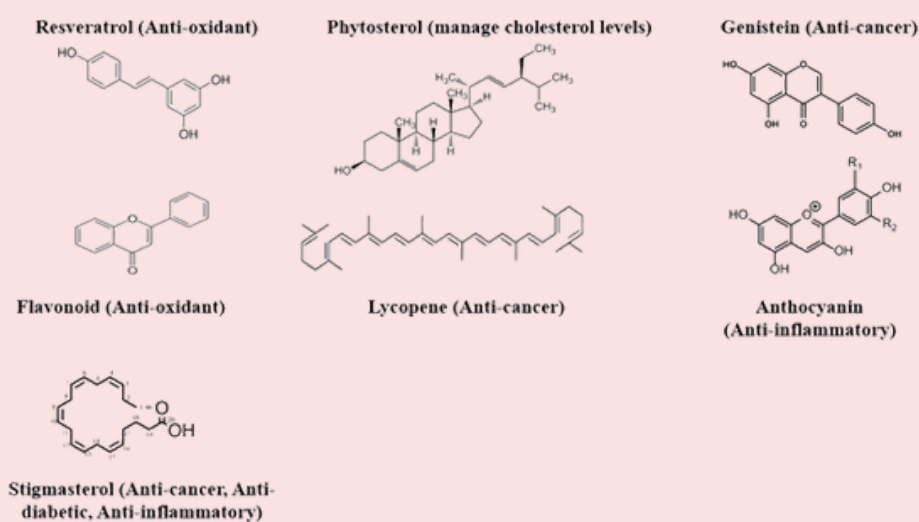


Figure 2. Chemical structures of phytochemical constituents with their activities

4. The rationale behind selecting phytopharmaceuticals to strengthen the immune system

Antioxidant potential of these Phytopharmaceuticals help in reducing oxidative stress which directly improves immunity. Human body undergo oxidative stress and cell damage due to psychological stress, environmental pollutants, polluted food, alcoholism and smoking. Thus, Indian diet food with all spices and herbs on daily basis can have an ameliorative effect in various ailments/health conditions (12). Contemporary sedentary lifestyle is making people deficient of nutrition and intake of junk food also contribute to declined immunity hence giving less priority to healthy easily accessible food at home.

To optimize the nutrition and promote a healthy immune system, the World Health Organization (WHO) advises people to eat a range of fresh, unprocessed meals every day. In order to reduce the risk of health issues and chronic diseases, they also advise avoiding excessive amounts of added sugar, fat, and sodium. Numerous health and wellness advantages are readily achievable by heeding their advice (13).

Additionally, the Food and Drug Administration (FDA) recognized all spices and herbs as safe for human consumption. Generally, herbs and spices are low in calories, fats and salt, thus, adding them into our daily diet will support immunity (14). Many plant-based drugs prevent cell damage due to their anti-oxidant and anti-inflammatory property. COVID-19 era was an excellent example, when significant improvement in immunity was seen on dietary interventions with Indian herbs and spices (15,16).

5. Mechanism of action of phytopharmaceuticals in activation of immune system

Phytopharmaceuticals act in different mechanisms to modulate immunity like Phagocytosis, activation of macrophage, cytokine secretion, antibody production, proliferation of lymphocytes as depicted in Figure 1.

It is well known that plant-based nutritional diets increase the number of good bacteria in the intestines, which support and make up as much as 85% of the immune system. The immune stimulation capacity of spices and their secondary metabolites was also demonstrated. The big intestine lining is known to benefit from non-digestible nutrients that specifically encourage the growth of proper intestinal bacterial flora. These nutrients may either attach to epithelia or be absorbed in the systemic circulation to boost the immune system after being digested by gut bacteria. Immunomodulation factors that have been examined include interferon-alpha (rINF- α), recombinant interferon-gamma (rINF- γ), and so on, possessed a strong antiviral activity and were suggested for usage either therapeutically or prophylactically in early-stage infections of several virus species.

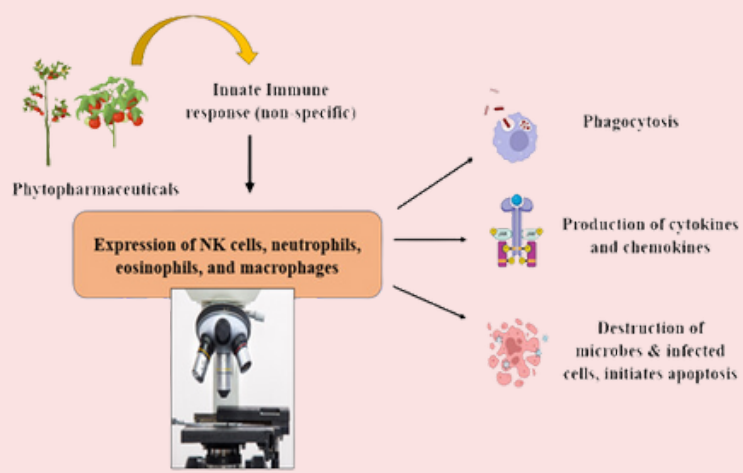


Figure 3. Mechanism of action of phytopharmaceuticals in activation of immune system

6. Conclusion

This article highlighted the significance of daily consumption of Indian herbs and spices that were considered as phytopharmaceuticals as a part of our daily diet. We Indians are fortunate to possess herbs like turmeric, fenugreek and curry leaves with immense medicinal properties that are consumed daily in our life, without which it is absolutely not possible to complete a meal. These herbs and spices consist of excellent therapeutic Phyto active constituents, which can be helpful for enhancing immunity and protection against infections. A human always relies on such type of phytopharmaceuticals that are beneficial all the time and doesn't need to include them as a separate medication.

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