

**A REVIEW ON MEDICINAL HERBS AS IMMUNITY BOOSTER****Aditi A. Gawai\*, Priyanka A. Shelke and Gajanana S. Sanap**

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Article Received on  
22 Nov. 2023,Revised on 12 Dec. 2023,  
Accepted on 02 Jan. 2024

DOI: 10.20959/wjpr20242-30947

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Maharashtra, India.**1. ABSTRACT**

Both active and passive immunity are components of the immune system. Active immunization produces antibodies against the antigens, which are then kept forever. However, when immunization occurs passively, antibody responses are triggered by the identical antigens in all previously infected patients. Herbal plants act as immune boosters to strengthen both the adaptive and innate immune responses. A number of herbal plants, such as *Zingiber officinale* (Ginger), *Allium sativum* (Garlic), *Emblica officinalis* (Amla), *Ocimum sanctum* (Tulsi), *Moringa oleifera* (Drumstick), and *Azadirachta indica* (Neem), have been shown in clinical studies to improve immunity. Herbal medications boost the immune system to protect against a variety of foreign infections while causing less adverse reactions than synthetic drugs. Numerous factors can lead to immune problems, which is the

root cause of numerous illnesses, including cancer. As a result, controlling factors affecting the immune response is a possibly helpful tactic in the fight against illness. Many immune supplements are currently used in clinical practice to improve the immune response and host defense capacity; still, artificial medicines may have adverse reactions. A plant-based bioactive substance increases immunity by various mechanisms, such as activating immune organs, humoral immunity, cellular immunity, nonspecific immunity, and signal transduction pathways connected with immunity.

The effectiveness of a person's immune system is greatly influenced by the specific nutrients and bioactive compounds they eat. The potential of these bioactive compounds to prevent a range of diseases has been deeply studied. Suitable foods have been consumed in various forms throughout numerous cultures and provide benefits over simply satisfying basic nutritional requirements. New nutritional foods are being made with trendy bioactive substances that have a range of immunomodulatory agent's properties, such as probiotics,

polyunsaturated fatty acids, and other phytoconstituents. In addition to immunomodulation, these compounds have antiviral, antibacterial, and antioxidant properties that affect immunity.

**KEYWORDS:-** Immunity, Types of immunity, Immunobooster, types of Immunobooster, How immune boosters function, Immune system functions and lifestyle factors, Immunoboosters and the prevention of illness, The Immune-Boosting Properties of Plant Bioactive Components(**Ginger, Tulsi, Fenugreek, Turmeric, Ginseng, Liquorices**).

## 2. INTRODUCTION

Among the biological systems in the body with the most complex is the immune system. It is a complicated and complex network of specialized cells, organs, proteins, and chemicals that is important to providing defense against cancerous cells and a variety of pathogens, including bacteria, viruses, and fungi.<sup>[1]</sup> It is widely recognized that both innate (Non-specific) and adaptive (Specific) immunity make up host immunity.<sup>[2,3]</sup> When the immune system fails to function properly, an organism becomes more at risk for infections, which can result in the onset of conditions like inflammatory bowel diseases, rheumatoid arthritis, and allergy diseases,<sup>[4,5 and 6]</sup> Plant-based functional foods are made from unprocessed or naturally occurring plant foods that may or may not contain bioactive ingredients.<sup>[7]</sup>

The immune system is composed of cells and proteins that connect to protect the skin, respiratory system, gastrointestinal tract, and other essential organs from foreign pathogens like germs, tumor cells, microbes (living organisms like bacteria, moulds, and worms), and poisons.<sup>[8]</sup> The innate immune system and adaptive immune function are the two "sections of stages" that make up the immune system's operation. The first line of defense against an invading germ is innate immunity. This is an example of a pathogen-independent (non-specific) defensive response that the organism develops fast or after being exposed to an antigen for more than a few hours.<sup>[9]</sup>

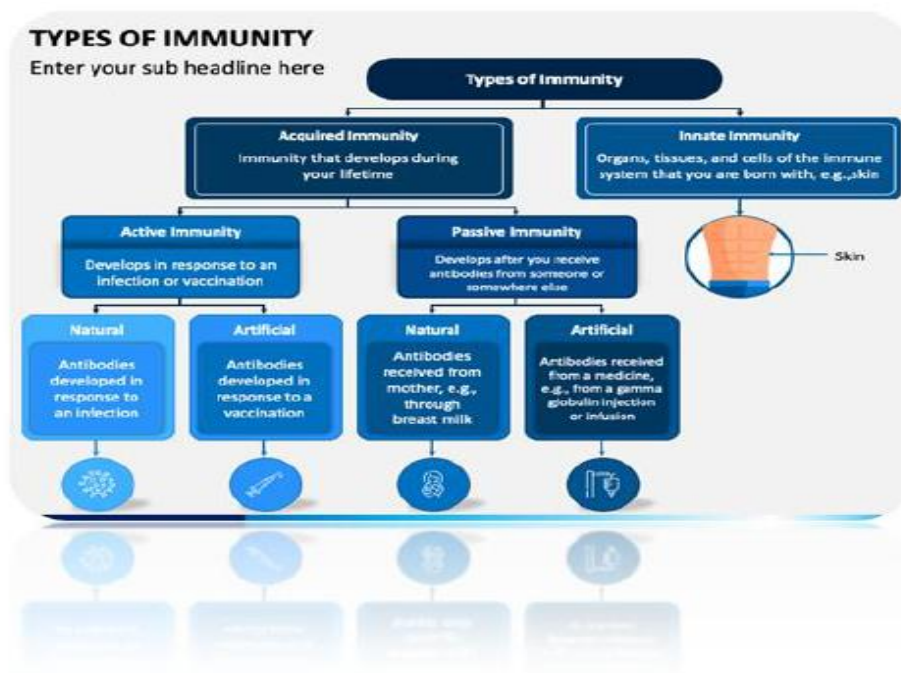
Even though the immune system's essential response lacks immunological memory, if the immune system is exposed to a particular germ frequently in the future, it is probably for the immune system to recall it and form "memories" of it. There is a delay earlier in the first contact of antigen with the best responses, and adaptive immune function is either pathogen-dependent or pathogen-specific.<sup>[10]</sup> Immune function is characterized by the potential for recall, which enables the body to generate a more rapidly reacting immune system reaction

following impending allergen recognition. Both innate immunity and adaptive immunity are thought of as identical defense mechanisms that enhance one another, with variations in either system leading to host reactivity.<sup>[11-13]</sup> The immune system is a complicated and multifaceted system that is essential to the body's defense against illnesses and infections.<sup>[14]</sup> It is in charge of identifying and eliminating dangerous pathogens, including bacteria, viruses, and parasites, as well as telling them apart from the body's healthy cells and tissues. White blood cells, antibodies, and cytokines are some of the elements that make up the immune system.<sup>[15]</sup> These components cooperate to drive out pathogens and stop them from spreading throughout the body. The immune system detects a pathogen as foreign when it enters the body and mounts an attack to eradicate the threat. Leukocytes, another name for white blood cells, are the main immune cells that aid in recognizing and getting rid of infections.<sup>[16]</sup> White blood cells come in a variety of forms, such as phagocytes, which engulf and eliminate infections, and lymphocytes, which produce antibodies to fend against infections. The immune system produces antibodies, which are proteins that attach to and recognize particular pathogens so that other immune cells can destroy them. Because of their extreme specificity, antibodies can only identify and attach to the particular pathogen that caused them to be produced. Immune cells produce chemical messengers called cytokines to control and direct the immune response. They are essential in triggering and guiding immune cells to the infection site so they can eliminate the pathogen.<sup>[17]</sup> Although the immune system is very good at defending the body against illnesses and infections, there are some things that can weaken it and increase the body's susceptibility to infection. These elements may consist of an unhealthy diet, inactivity, long-term stress, and exposure to pollutants in the environment.<sup>[18]</sup>

Substances or techniques known as "immunoboosters" are thought to improve immune system performance. They can consist of different vitamins and minerals, probiotics, herbal supplements, and lifestyle elements like exercise and stress management methods. Immunoboosters are designed to give the body the tools it needs to maximize immune response and guard against infection.<sup>[19]</sup>

### 3. TYPES OF IMMUNO-BOOSTERS

Substances known as immunoboosters are used for improving the immune system, which aids the body's defense against illnesses and infections. There are numerous varieties of immunoboosters on the market,<sup>[20]</sup> including:



**3.1 Natural substances:** Herbs, minerals, and vitamins are frequently utilized as organic immunoboosters. They support the healthy and effective operation of the immune system. For instance, vitamin C aids in promoting the development of white blood cells, the body's basic line of defense against infections. Zinc aids white blood cells in their defense against harmful viruses and bacteria, which make it crucial for immune system, function as well. Herbs with antiviral and antibacterial qualities, such as garlic and echinacea, are thought to aid the body in fighting off infections.

**3.2 Vaccines:** - A particular class of Immunoboosters has known as vaccines functions by injecting a small quantity of the pathogen into the body. This boosts the production of antibodies by the immune system to recognize and fight the disease-causing agent itself in the future. Immunizations have proven to be very successful in stopping the spread of infectious illnesses like COVID-19, polio, and measles.

**3.3 Medications:** The term "immune modulators" refers to drugs that control immune system function. Diseases like cancer, autoimmune conditions, and chronic infections can all be treated using them. By strengthening the immune system's response, interferon, for instance, is a drug used to treat specific cancers and viral infections. Rheumatoid arthritis

and other autoimmune diseases can be treated with interleukins, another class of immunomodulator.

**3.4 Lifestyle changes:** Some aspects of one's lifestyle may improve the immune system. This includes eating a balanced diet, managing stress, exercising frequently, and getting adequate sleep. Sleep is essential for the body's ability to heal and recover cells, especially immune cells. By enhancing blood flow and lowering inflammation, exercise can also aid in enhancing immune function. Stress can impair immunity and increase susceptibility to infections, so it's critical to manage it. Last but not least, maintaining a nutritious diet rich in fruits, vegetables, and whole grains can give the body the building blocks it requires to maintain immune function.

#### **4. HOW IMMUNE BOOSTERS FUNCTION**

Immunoboosters can lessen the chance of infection and disease by enhancing the immune system's capacity to recognize and eliminate these foreign bodies. We will look at the various kinds of Immunoboosters and their mechanisms of action in this article.<sup>[21]</sup>

**4.1 Vitamins and Minerals:** - Immune system support is greatly enhanced by vitamins and minerals. As an example, white blood cells, which are essential in the fight against infections, are produced only with the help of vitamin C. Improving the functioning of immune cells is another important role of vitamin E. Additionally, by promoting the existence and development of immune cells, minerals like iron, zinc, and selenium can enhance immune function.

**4.2 Probiotics:** - Live microorganisms known as probiotics have been shown to improve immune function among other health benefits. These microbes have the ability to increase the generation of antibodies, which are important for the defense against infections. Additionally, probiotics have the ability to improve the performance of immune cells, including natural killer cells and T cells, which are essential for recognising and removing foreign invaders.

**4.3 Medicinal herbs:** - Herbs Used for Medicine A few therapeutic herbs may strengthen the immune system. For example, echinacea is a well-known herb which has been utilized for years to improve immune system performance. It has the ability to boost immune cell

activity and white blood cell production. By promoting immune cell activity, additional plants like astragalus, ginseng, and turmeric can also strengthen the immune system.

**4.4 Exercise:** - Exercise lowers stress levels and increases blood flow, both of which can strengthen the immune system. Regular exercise can also increase the production of antibodies and white blood cells, both of which are important for facing infections. Additionally, exercise is helpful in reducing inflammation, which enhances the immune system.

**4.5 Sleep:** - Sleep Sustaining immune function calls for getting enough sleep. The body creates cytokines-proteins that are useful in the fight against inflammation and infections while you sleep. Insufficient rest raises the probability of infections and weakens the immune system.

**4.6 Vaccines:** - Vaccines function by inducing the production of particular antibodies by the immune system against a given pathogen. A tiny quantity of the pathogen is introduced to a person's immune system during vaccination, which causes the body to produce antibodies. If the individual is afterwards made into the pathogen again, these antibodies will be able to identify it and remove it.

**4.7 Immunomodulators:** - It is possible to modulate the immune response with substances known as immunomodulators. In different circumstances, they can either boost or suppress immune function. Examples of immune modulators may be utilized to suppress immune function in people with autoimmune diseases or to boost immune function in cancer patients having chemotherapy.

Immunoboosters occur in a variety of methods and may improve immunity. Immunomodulators, probiotic, vitamins and minerals, herbal remedies, exercising, sleep, and vaccinations can all be very helpful in boosting immunity. To improve immune function the rule is important to lead a healthy lifestyle and see a doctor before implementing any supplements or prescription drugs.

## 5. IMMUNE SYSTEM FUNCTIONS AND LIFESTYLE FACTORS

Important roles for decisions about life are also played by them when it comes to preserving immunological health.<sup>[22]</sup> The following are a few habits that can improve immune function:

**5.1 Sleep:** The body needs sufficient rest to be able to recover and fix itself. The immune system releases cytokines while you sleep, helping in the fight against inflammation and infection.

**5.2 Diet:** Consuming a diet rich in various types of fruits, vegetables, whole grains, lean meats, and healthy fats can give the body the nourishment it requires for strong immune system performance. Immune system function is especially affected by minerals like zinc and selenium as well as vitamins A, C, D, and E.

**5.3 Exercise:** Frequent exercise can enhance immune function by lowering inflammation, boosting the formation of white blood cells and antibodies, and improving circulation.

**5.4 Stress management:** Excessive stress can weaken the immune system, increasing the body's susceptibility to infections. Approaches like yoga, deep breathing, and mindfulness meditation can boost immunity and lower stress.

**5.5 Avoiding harmful habits:** The immune system can be weakened by smoking and excessive drinking, which raises the risk of infections.

## 6. IMMUNOBOOSTERS AND THE PREVENTION OF ILLNESS

Immunoboosters operate by enhancing the immune system's defense against infections, which helps fight off illnesses like the flu and colds. The immune system can be improved in a number of ways, such as by getting enough sleep, exercising frequently, eating a balanced diet, and taking specific supplements. For example, it is well known that zinc, vitamins C and D, and other nutrients can strengthen immunity.

A nutritious diet rich in fruits and vegetables is a further way for boosting the immune system. Antioxidants, which are plenty in fruits and vegetables, protect cells from harm triggered by free radicals. Additionally, antioxidants can lessen inflammation in the body, which enhances immunological performance.<sup>[23]</sup>

## 7. THE IMMUNE-BOOSTING PROPERTIES OF PLANT BIOACTIVE COMPONENTS

### 7.1 Ginger

- **Synonyms:** Zingiber, Zingiberis.
- **Biological source:** Ginger consists of rhizomes of *Zingiber officinale*.



- **Family:** Zingiberaceae



- **Description:-** As an essential ingredient for a variety of foods and drinks, ginger, which is the rhizome of *Zingiber officinale*, is one of the most commonly utilized species of the ginger family (Zingiberaceae). For illnesses including headaches, nausea, rheumatism, and colds, ginger has been used medicinally for over 2500 years in China and India. It is cultivated in the Caribbean Islands, Africa, Australia, Taiwan, and India, although it is thought to be native to Southeast Asia.<sup>[24-29]</sup>
- **Active constituents:** - There are several strong components and active components in ginger. Ginger oil, which is mostly composed of zingiberene and other sesquiterpene hydrocarbons, is obtained by steam distilling powdered ginger. Studies on the lipophilic rhizome extracts of ginger have identified the principal pungent compounds, which have resulted in potentially active gingerols that can be further processed into shogaols, zingerone, and paradol. Its distinct flavor appears to be attributed to the compound 6-gingerol. Fresh ginger contains trace amounts of gingerone and shogaols, whereas dried or extracted products contain higher concentrations of these compounds.
- **Mechanisms of action:** - Ginger's carminative, aromatic, spasmolytic, and absorbent qualities indicate that it affects the GI tract directly. Pharmacological activities of 6-gingerol and 6-shogaol have been shown, that includes antipyretic, analgesic, antitussive, and hypotensive effects. Strong anti-inflammatory and antioxidant effects belong to zingerone, gingerols, paradols, sesquiterpenes, and shogaols. Research conducted on different models indicates that the ginger extract decreases inflammation in patients suffering from illnesses like rheumatoid arthritis, inflammatory bowel disease, asthma, and specific types of cancer. TNF alpha and C-reactive proteins, two major inflammatory proteins, were markedly decreased in a human clinical trial applying ginger powder. The



anti-inflammatory, antifungal, and anticancer properties of ginger are widely recognized. Ginger has long been used in conventional medicine to treat a wide range of conditions; including depression, gastrointestinal issues, asthma, travel sickness, morning sickness, colds, and coughs. Drink it as ginger tea, which is made by crushing ginger and adding water and tea leaves to boil. Since the beginning of time, powdered ginger has been combined with ground cloves, cardamom, and caraway to treat digestive issues.

## 7.2 Tulsi

- **Synonyms:** Holy basil.
- **Biological source:** Tulsi is an aromatic perennial plant of *Ocimum sanctum* in the family.
- **Family:** Lamiaceae.



- **Description:** - Native to the Indian subcontinent, holy basil grows all over Southeast Asia. The plant is revered in Hinduism and is frequently used as a herbal tea for a range of illnesses in traditional and conventional medicine. It is also used as a culinary herb because of its strong flavor, which gets stronger when cooked. It has a peppery spicy flavor that is similar to cloves, mint, and Italian basil (the *Ocimum basilicum*). In certain areas far from its natural range, it is seen as an invasive species and an agricultural weed.<sup>[30-35]</sup>
- **Active constituents:** - The plant *Ocimum sanctum* contains a wide range of chemicals, including carvacrol,  $\beta$ -elemene,  $\beta$ -caryophyllene, ursolic acid, rosmarinic acid, eugenol, and germacrene. *Ocimum holy* is thought to possess booster and diuretic effects.

- **Mechanism of action:** - Tulsi possesses a special set of properties that make it effective against a wide range of microorganisms. These include antimicrobials (Such as antibacterial, antiviral, antifungal, antiprotozoal, antimalarial, and anthelmintic); mosquito repellent; anti-diarrheal; antioxidant; anti-cataract; anti-inflammatory; chemopreventive; radioprotective; hepatoprotective; neuroprotective; cardioprotective; anti hypercholesterolemia; antihypertensive; anticarcinogenic; analgesic; antipyretic; anti-allergic; immunomodulatory; central nervous system depressant; memory-enhancement; anti-asthmatic, antitussive, diaphoretic, antithyroid as well as infertility. These pharmacological effects support the recovery of biological and mental function while helping both the mind and the body in managing a variety of chemical, physical, infectious, and emotional stressors. This readily accessible plant's leaves are a rich source of phytonutrients, including flavonol and antioxidants, as well as vitamins, minerals, chlorophyll, and eugenol, a bioactive substance with antibacterial, antifungal, and antimicrobial qualities that also lowers stress and plasma glucose levels. Every morning, you may flavor your cup of tea with 4–5 fresh basil leaves, or chew them (just make sure to wash them thoroughly under running water). Another essential part of pesto recipes is basil.

### 7.3 Fenugreek

- **Synonyms:** Methi.
- **Biological source:** Fenugreek consists of leaves of *Trigonella foenumgraecum*.
- **Family:** Fabaceae.



- **Description:** - In India and the Mediterranean region, fenugreek is planted as a crop during the cool months under both watering and rainfall. It develops on a variety of usually well-draining soil with a pH that ranges from 5.3 to 8.2. Fenugreek occurs

naturally in area seems, undeveloped the surface, dry grasslands and valleys in semi-highland and mountain regions.<sup>[36-38]</sup>

- **Active constituent:** - The main components of fenugreek seeds include nitrogen compounds that fall into the non volatile and volatile constituent categories, as well as carbohydrates, proteins, lipids, alkaloids, flavonoids, fibers, saponins, and steroids.
- **Mechanism of action:** - There are a lot of health benefits related to fenugreek. Fenugreek seeds are a simple way to treat gastric ulcers. The hydrating properties of the seed oil leave skin feeling softer and smoother. Fenugreek is an important plant because of its cleansing properties, which include helping to eliminate the body, tidy the lymphatic system, and purify the blood. It can be applied to conditions like sinus infections and hay fever. The seeds are thought to have heart health benefits, act as an aphrodisiac, and stimulate lactation as a galactagogue. Fenugreek serves for various reasons across various regions of the world. As an example, in China, the seeds of this plant are used to treat kidney issues and cervical cancer. In the Middle East and the Balkans, the plant's aerial parts are used to relieve diarrhea-related stomach cramping. Roasted seeds are used to treat diarrhea in Southern India. As a cooling agent, a seed infusion is also administered to the smallpox patients. Well-known in the Ayurvedic medical system, fenugreek boosts immunity and functions as a natural antioxidant. In addition to being used as a herb (fresh or dried leaves), flavor (seeds), and vegetable (fresh leaves), it can also be used as an additive to make artificial maple syrup flavoring or to make steroids. Due to their high vitamin E content, fenugreek seeds can be added to pickles as a preservative. Fenugreek leaves that have been dried are used to flavor meat, fish, and vegetable dishes. Fenugreek, honey, and lemon are combined to make herbal tea that is traditionally used to treat fever. Fenugreek microgreens and sprouted seeds are used in salads, and fenugreek fiber helps ease constipation.

#### 7.4 Turmeric

- **Synonyms:** Haldi, Halada.
- **Biological source:** Turmeric (called Haldi in Hindi language), and named by the British as curry spice, is the dried rhizome powder of *Curcuma longa*.
- **Family:** Zingiberaceae



- **Description:** - The three to five-foot-tall turmeric plant has yellow flowers that look like funnels and oblong, pointed leaves with short stems. Asia, India, China, and other tropical nations thoroughly grow a precious moneymaker known as turmeric rhizome. Turmeric is frequently used as a food additive, spice for curries, and nutritional pigment.<sup>[39-44]</sup>
- **Active constituent:** - The polyphenol compound curcumin (diferuloylmethane), which gives turmeric its sharp yellow color, is considered to be the main pharmacological ingredient. Turmeric includes the curcuminoids atlantone, bisdemethoxycurcumin, demethoxycurcumin, diarylheptanoids, and turmerone in along with curcumin.
- **Mechanism of action:-** According to studies, curcumin has a number of pharmacological characteristics, such as wound healing, chemo sensitizing, radio sensitizing, antiviral, antifungal, antioxidant, and anti-inflammatory effects. In tests on animals, curcumin inhibits the growth, metastatic disease, and beginning of tumors. By causing cell death and micro nucleation, disturbing mitotic spindle structures, and stopping the cell cycle, it can also have anti proliferative effects. Curcumin appears to be a pluripotent pharmacological agent that promotes itself in biological systems through a variety of molecular processes. Turmeric's primary ingredient, curcumin, has been shown to be the source of its clinically beneficial effects. Additionally, curcumin has a critical function in immune system modification. Turmeric has been shown to have prebiotic-like features that allow it to modify the gut microbiota and improve the gut-immune relationship. Curcumin has the ability to reduce cortisol levels, which in turn support immune system balance. It is significant because cortisol receptors, which cause changes in cortisol, are present in every immune cell.

### 7.5 Ginseng

- **Synonyms:** Ninjin, Pannag, Panax.
- **Biological source:** Ginseng is the dried root of various species of panax such as Panax ginseng (Korean), Panax japonicus (Japanese), Panax notoginseng (Chinese), and Panax quinquefolium (American).
- **Family:** Araliaceae



- **Description:** - Panax ginseng is a member of the Araliaceae family and is native to Russia and East Asia. Although it is native to isolated forests in North Korea and Manchuria, it has been overharvested in other Asian regions. It is grown for export and medical purposes in China, Japan, and Korea. The deciduous perennial Panax ginseng prefers shade and features five-fingered leaves, tiny white flowers, red berries, and a yellowish-brown root. While all of the plant's components contain active compounds, the root is used for medicinal purposes.<sup>[45-47]</sup>
- **Active constituents:** - Triterpene glycosides, also known as saponins or ginsenosides, are found in Panax ginseng. All sections of the plant contain a variety of active substances, such as proteins, polypeptides, alkaloids, phenols, amino acids, and vitamins B1 and B2.
- **Mechanism of action:** - The term "adaptogen," which is frequently applied to the plant Panax ginseng, indicates it has a variety of physiological effects, including promoting non-specific resistance to both physical and biochemical stressors, increasing lifespan, and enhancing mental abilities. According to reviews, Panax ginseng modulates immunity through influencing the hypothalamic-pituitary-adrenal (HPA) axis. In vitro tests show that exposure to ginsenoside increases immune cell phagocytosis and natural killer (NK) cell activity. Ginseng saponins "are thought to decrease serum prolactin, thereby increasing libido" in male impotence, according to a 1999 WHO review.



## 7.6 Liquorice

- **Synonyms:** Glycyrrhiza, Glycyrrhizae radix, Mulethi.
- **Biological source:** It consists of dried, peeled, unpeeled, root, and stolon of *Glycyrrhiza glabra*.
- **Family:** Leguminosae.



- **Description:-** The liquorice shrub, which belongs to the pea family, can reach a height of 4 or 5 feet when grown in rich soil in subtropical regions. It features flat pods, clusters of white to purplish flowers, and oval leaflets. The liquorice plant has a vast underground root structure that consists of multiple participants and a main taproot. The main taproot is soft, fibrous, and has a bright yellow interior. It is collected for medicinal purposes.<sup>[48-51]</sup>
- **Active constituents:** - Licorice has been shown to contain a variety of components, such as a water-soluble, biochemically active complex that makes up between 40 and 50 percent of the dry material weight. Triterpene saponins, flavonoids, polysaccharides, pectin, simple sugars, amino acids, mineral salts, and other substances make up this complex. The taste of licorice root is sweet due to glycyrrhizin.
- **Mechanisms of action:** - Licorice has several beneficial effects that can be explained by different mechanisms. Numerous ribonucleic acid and deoxyribonucleic acid viruses, such as hepatitis A9 and C, herpes zoster, the human immunodeficiency virus, and herpes simplex, have been shown to be prevented in development and cytopathology by glycyrrhizin and glycyrrhizin acid. Additionally, glycyrrhizin and its metabolites reduce 5-βreductase and block hepatic metabolism of aldosterone, two factors that are causing the well-known pseudo aldosterone syndrome. The mineralocorticoid and glucose corticoid actions of glycyrrhizin acid are explained by the structural similarities to



hormones released by the adrenal cortex. Additionally, components of liquorices have anti-inflammatory properties identical to those of steroids, such as hydrocortisone.

## 8. CONCLUSION

In conclusion, keeping our immune systems healthy is important for our general health as they play a major part in defending our bodies against illnesses. Maintaining your health and boosting your immune system can be achieved through adopting a healthy lifestyle. Although there are allopathic medications that can fight oxidative stress and thereby boost immunity, it is essential to look for a different option due to the side effects and high price of these medications. In terms of natural drug development, ayurvedic medicines have a promising profile. Herbals are expected to serve as the main ingredient in the creation of an affordable, efficient, and safe immunomodulatory drug. The whole human race is suffering as a result of the COVID-19 pandemic.

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