Review Article

Review on Immunomodulation and Immunomodulatory Activity of Some Herbal Plants

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ABSTRACT

The immune system is one of our most complex biological systems in the body. Immunization may be active or passive. The active immunization involves stimulation with an antigen to develop immunological defences against a future exposure and passive immunization involves administration of preformed antibodies to an individual who is already exposed to be exposed to an antigen. Immunomodulatory agents originate from both plant and animal which increases the immune responsiveness of the body against pathogens by activating the non specific immune system. The immune system dysfunction is responsible for various diseases like allergy, asthma, arthritis, cancer and other infectious diseases. So modulation of immune responses too much required to controlling the various infectious diseases. The texts of traditional Indian medicine literature consist of a number of plants reputed to promote physical and mental health, improve defence mechanisms of the body and enhance longevity, lesser number of side effects against synthetic immunomodulatory agent.

Keywords: Immunomodulators, Immune system, Cytokines, T-cells.

INTRODUCTION

Immune system is a remarkably sophisticated defence system within vertebrates, to protect them from invading agents. It is able to generate varieties of cells and molecules capable of recognizing and eliminating limitless varieties of foreign and undesirable agents. Modulation of the immune system denotes to any change in the immune response that can involve induction, expression, amplification or inhibition of any part or phase of the immune response. Thus, immunomodulator is a substance used for its effect on the immune system. There are generally of two types immunomodulators based on their effects: immunosuppressants and immunostimulators. Immunopharmacology is a comparatively new and developing branch of pharmacology aims at searching for immunomodulators. The potential uses of immunodulators in clinical medicine include the reconstitution of immune deficiency (e.g. the treatment of AIDS) and the suppression of normal or excessive immune function (e.g. the treatment of graft rejection or autoimmune disease). Specific immunomodulators administered together with antigens known as immunological adjuvants to boost the immune response to the vaccine constituents.[1]The basic function of immune system is to protect against foreign pathogens and infectious agents. This is achieved either through innate or natural immunological mechanisms which essentially serve as a short term first line defence or through elaborate adaptive mechanisms which are highly specific, complex, and marked by diversity and memory. In both types of immunity, cells and molecules play important roles.[2] Immunology is thus probably one of the most rapidly developing areas of biomedical research and has great promises with regard to the prevention and treatment of a wide range of disorders.[3] The immune response has two ways of dealing with foreign pathogens. The B-lymphocytes synthesize specific antibodies called immunoglobulins. This is known as humoral immunity. The other system involves T-lymphocytes, which regulate the synthesis of antibodies as well as direct killer cell activity and the inflammatory response of delayed type hypersensitivity. This system is known as cell-mediated immunity.[4] Herbs are selected and combined for their ability to inhibit microbial overgrowth in various parts of the body and support those organ systems responsible for immune functions.[5]Plant extracts are potentially curative. Some of these extracts can improve the humoral and cell mediated immunity, against virsuses, bacteria, fungi, protozoa.[6] For instance, a plant origin saponin used in veterinary medicine whereas, the non-specific immunostimulators offer a generalized state of resistance to pathogens or tumors.[6]

IMMUNE SYSTEM

The immune system is composed of many interdependent cell types that collectively protect the body from bacterial, parasitic, fungal, viral infections and from the growth of tumor cells. Many of these cell types have specialized functions. The cells of the immune system can engulf bacteria, kill parasites or tumour cells, or kill viral-infected cells. Often, these cells depend on the T helper subset for activation signals in the form of secretions formally known as cytokines, lymphokines, or more specifically interleukins.

The Innate Immune System

Innate immunity comprises a series of host defenses including barrier function, cytokines, complement, phagocytes, natural killer (NK) cells, and gamma-delta (gd) T cells to provide the initial (nonspecific) response to a pathogen or injury. These responses are phylogenetically ancient and have been developed to

cope with pathogens that are encountered regularly but that rarely cause disease. Unlike the adaptive (specific) immune system, responses are generic and leave no memory; nonetheless the innate immune system functions effectively to keep organisms healthy. Indeed a failing in innate immunity is hypothesized to contribute to secondary infections in critical illness and death in sepsis. Stimulation of the active components of the innate immune system occurs by way of pathogen-associated molecular pattern (PAMP) receptors or damage-associated molecular pattern (DAMP) receptors. PAMPs are recognized by membrane bound or vesicular pathogen recognition receptors (PRRs) including the Toll-like receptors (TLRs), nucleotide binding oligomerization domain (NOD)-like receptors, and RIG-I like receptors. Bacteria stimulate these PRRs to activate various intracellular signalling cascades, leading to a proinflammatory response. For example, the gram-negative bacteria endotoxin, lipopolysaccharide, binds to TLR 4, whereas the gram-positive peptidoglycan binds to TLR 2 In the setting of tissue damage from an infection or trauma, DAMPs activate the innate immune system through these PRRs. Indeed there is significant overlap in mechanisms stimulated by PAMPs and DAMPs. As sedatives are frequently administered during infection and surgery, investigation of their immune effects on these mechanisms of immune stimulation would seem prudent.

The Adaptive Immune System

Adaptive or acquired immunity differs from the innate response as it is specific, has an element of memory, and is unique to vertebrates. The humoral component involves the proliferation of antigen-stimulated B lymphocytes into antibody-secreting plasma cells. The cellular component is mediated by T lymphocytes, the predominant cell types being helper T cells (Th) and cytotoxic T cells. Recently, regulatory T cells that likely dampen the immune response have been identified. T cells recognize antigens bound to major histocompatibility complex (MHC) proteins by way of T cell receptors that are antigen specific. Th lymphocytes act through secretion of cytokines to elaborate and prime the immune response. This action includes inducing immunoglobin classs witching of B cells, activation of Tc, and optimization of bactericidal capacity of phagocytes. Th lymphocytes are characterized by expression of CD4 proteins and are activated when MHC type II molecules, expressed on professional antigen-presenting cells (dendritic cells, macrophages, and B cells), activate the specific T cellreceptor.Th1 cells are regarded as ”proinflammatory’’ secreting cytokines such as interferon-g and interleukin (IL)-12, and stimulate macrophage function and cytotoxic T cell function. Th2 cells have an “anti-inflammatory” phenotype and secrete cytokine such as IL-4 and IL-10, acting cooperatively to activate B cells. Further, Th cells include the regulatory T cells that act to dampen the immune response and the Th17 class that modulates neutrophil function. A shift from Th1 to Th2 cells has been observed in the latter stages of sepsis, possibly induced by the apoptotic cell death of lymphocytes, and the subsequent anti-inflammatory phenotype has been associated with secondary infections in this patients.[8]

The Organs of the Immune System[9-11]

Bone Marrow: All the cells of the immune system are initially derived from the bone marrow. They form through a process called hematopoiesis. During hematopoiesis, bone marrow-derived stem cells differentiate into either mature cells of the immune system or into precursors of cells that migrate out of the bone marrow to continue their maturation elsewhere. The bone marrow produces B cells, natural killer cells, granulocytes and immature thymocytes, in addition to red blood cells and platelets.

Thymus: The function of the thymus is to produce mature T cells. Immature thymocytes, also known as prothymocytes, leave the bone marrow and migrate into the thymus. Through a remarkable maturation process sometimes referred to as thymic education, T cells that are beneficial to the immune system are spared, while those T cells that might evoke a detrimental autoimmune response are eliminated. The mature T cells are then released into the bloodstream.

Spleen: The spleen is an immunologic filter of the blood. It is made up of B cells, T cells, macrophages, dendritic cells, natural killer cells and red blood cells. In addition to capturing foreign materials (antigens) from the blood that passes through the spleen, migratory macrophages and dendritic cells bring antigens to the spleen via the bloodstream. An immune response is initiated when the macrophage or dendritic cells present the antigen to the appropriate B or T cells. This organ can be thought of as an immunological conference center. In the spleen, B cells become activated and produce large amounts of antibody. Also, old red blood cells are destroyed in the spleen.

Lymph nodes: The lymph nodes function as an immunologic filter for the bodily fluid known as lymph. Lymph nodes are found throughout the body. Composed mostly of T cells, B cells, dendritic cells and macrophages, the nodes drain fluid from most of our tissues. Antigens are filtered out of the lymph in the lymph node before returning the lymph to the circulation. In a similar fashion as the spleen, the macrophages and dendritic cells that capture antigens present these foreign materials to T and B cells, consequently initiating an immune response.

The Cells of the Immune System[12-15]

T-Cells: T lymphocytes are usually divided into two major subsets that are functionally and phenotypically (identifiably) different. The T helper subset, also called the CD4+ T cell, is a pertinent coordinator of immune regulation. The main function of the T helper cell is to augment or potentiate immune responses by the secretion of specialized factors that activate other white

blood cells to fight off infection. Another important type of T cell is called the T killer/suppressor subset or CD8+ T cell. These cells are important in directly killing certain tumor cells, viral-infected cells and sometimes parasites. The CD8+ T cells are also important in down-regulation of immune responses. Both types of T cells can be found throughout the body. They often depend on the secondary lymphoid organs (the lymph nodes and spleen) as sites where activation occurs, but they are also found in other tissues of the body, most conspicuously the liver, lung, blood, and intestinal and reproductive tracts.

Natural Killer Cells: Natural killer cells, often referred to as NK cells, are similar to the killer T cell subset (CD8+ T cells). They function as effector cells that directly kill certain tumors such as melanomas, lymphomas and viral-infected cells, most notably herpes and cytomegalovirus-infected cells. NK cells, unlike the CD8+ (killer) T cells, kill their targets without a prior "conference" in the lymphoid organs. However, NK cells that have been activated by secretions from CD4+ T cells will kill their tumor or viral-infected targets more effectively.

B Cells: The major function of B lymphocytes is the production of antibodies in response to foreign proteins of bacteria, viruses, and tumor cells. Antibodies are specialized proteins that specifically recognize and bind to one particular protein that specifically recognize and bind to one particular protein. Antibody production and binding to a foreign substance or antigen, often is critical as a means of signalling other cells to engulf, kill or remove that substance from the body.

Granulocytes or Polymorphonuclear (PMN) Leukocytes: Another group of white blood cells is collectively referred to as granulocytes or polymorphonuclear leukocytes (PMNs). Granulocytes are composed of three cell types identified as neutrophil, eosinophils and basophils, based on their staining characteristics with certain dyes. These cells are predominantly important in the removal of bacteria and parasites from the body. They engulf these foreign bodies and degrade them using their powerful enzymes.

Macrophages: Macrophages are important in the regulation of immune responses. They are often referred to as scavengers or antigen-presenting cells (APC) because they pick up and ingest foreign materials and present these antigens to other cells of the immune system such as T cells and B cells. This is one of the important first steps in the initiation of an immune response. Stimulated macrophages exhibit increased levels of phagocytosis and are also secretory.

Dendritic Cells: Another cell type, addressed only recently, is the dendritic cell. Dendritic cells, which also originate in the bone marrow, function as antigen presenting cells (APC). In fact, the dendritic cells are more efficient apcs than macrophages. These cells are usually found in the structural compartment of the lymphoid organs such as the thymus, lymph nodes and spleen. However, they are also found in the bloodstream and other tissues of the body. It is believed that they capture antigen or bring it to the lymphoid organs where an immune response is initiated. Unfortunately, one reason we know so little about dendritic cells is that they are extremely hard to isolate, which is often a prerequisite for the study of the functional qualities of specific cell types. Of particular issue here is the recent finding that dendritic cells bind high amount of HIV, and may be a reservoir of virus that is transmitted to CD4+ T cells during an activation event.

Immunomodulators

Modulate and potentiate the weapons of your immune system keeping them in a highly prepared state for any threat it may encounter. With this balancing effect, all subsequent immune responses improve. When your immune system is in this highly prepared state, the invading organisms do not have the time to build up force and strength before the immune system attacks destroys and/or weakens the invader. Immunomodulation is the process of modifying an immune response in a positive or negative manner by administration of a drug or compound. Many proteins, amino acids, and natural compounds have shown a significant ability to regulate immune responses, including interferon-γ (IFN-γ), steroids, DMG. These are biological or synthetic substances, which can stimulate, suppress or modulate any of the immune system including both adaptive and innate arms of the immune response. Clinically immunomodulators can be classified into following three categories.[16]

Immunoadjuvant: These agents are used for enhancing vaccines efficacy and therefore, could be considered specific immune stimulants 31 example in this regard is of Freud's adjuvant. The immunoadjuvant hold the promise of being the true modulators of immune response. It has proposed to exploit them for selecting between cellular and humoral, Th1 (helper T1 cells) and Th2, (helper T2 cells) immunoprotective and immunodestructive, and reagenic (IgE) versus immunoglobin G (IgG) type of immune responses, which poses to be a real challenge to vaccine designers.[17]

Immunostimulant: These agents are inherently non-specific in nature as they envisaged enhancing body's resistance against infection. They can act through innate immune response and through adaptive immune response. In healthy individuals the Immunostimulant are expected to serve as prophylactic and promoter agents i.e. as immunopotentiators by enhancing basic level of immune response, and in the individual with impairment of immune response as immunotherapeutic agents.[18-24]

Immunosuppressants: These are a structurally and functionally heterogeneous group of drugs, which are often concomitantly administered in combination regimens to treat various types of organ transplant rejection and autoimmune diseases.[24]

Methods for Testing Immunological Factors [25]

The routine process for screening is to extract single ingredient or single distilled fraction from herbal drugs, determine its bioactivity by the classic pharmacological means. The whole animal model is the most classic pharmacological screening model, which is very important at the aspect of medicine evaluation because it can apparently respond to the efficacy, side effect and toxicity of medicines in whole. Although this method is high cost and low efficient, at present it is still a primary way to drug discovery and evaluation.

Several *in vitro*, *in vivo* methods of pharmacological screening of medicinal plants having immunomodulatory activity have been listed.

***In vitro* methods:**

1. Inhibition of histamine release from mast cells
2. Mitogens induced lymphocyte proliferation
3. Inhibition of T cell proliferation
4. Chemiluminescence in macrophages
5. PFC (plaque forming colony) test *in vitro*
6. Inhibition of dihydro-orotate dehydrogenase

***In vivo* methods:**

1. Spontaneous autoimmune diseases in animals
2. Acute systemic anaphylaxis in rats
3. Anti-anaphylactic activity (Schultz-Dale reaction)
4. Passive cutaneous anaphylaxis
5. Arthus type immediate hypersensitivity
6. Delayed type hypersensitivity
7. Reversed passive arthus reaction
8. Adjuvant arthritis in rats
9. Collagen type II induced arthritis in rats
10. Proteoglycan-induced progressive polyarthritis in mice
11. Experimental autoimmune thyroiditis
12. Coxsackievirus B3-induced myocarditis
13. Porcine cardiac myosin-induced autoimmune myocarditis in rats
14. Experimental allergic encephalomyelitis
15. Acute graft versus host disease (GVHD) in rats
16. Influence on SLE-like disorder in MRL/lpr mice
17. Prevention of experimentally induced myasthenia gravis in rats
18. Glomerulonephritis induced by antibasement membrane antibody in rats
19. Auto-immune uveitis in rats
20. Inhibition of allogenic transplant rejection.

DISCUSSION

Immunomodulation using medicinal plants can provide an alternative to conventional chemotherapy for a variety of diseases especially when host defense mechanism has to be acquired under the conditions of impaired immune responsiveness[61]. Indian medicinal plants are a rich source of substances which are claimed to induce paraimmunity, the non-specific immunomodulation of especially granulocytes, macro-pages, natural killer cells and competent functions. Immunostimulation and immunosuppression both need to be tackled in order to regulate the normal immunological functioning. Therefore, stimulatory or suppressive agents have been shown to possess activity to normalize or modulate pathophysiological processes and are hence called' 'immunomodulatory agents'. Among the suppressive synthetic substances, cyclophosphamide has been extensively studied.[62] However; the major drawback of this drug is myelosuppression, which is undesirable. Moreover, natural adjuvants, synthetic agents, antibody reagents are used as immunomodulatory agents. Nevertheless, there are major limitations to the general use of these agents such as increased risk of infection and generalized effect throughout the immune system. As an upshot, there is high pre-valence of usage of herbal plants to treat diseases of immune system for hundreds of years. Besides, compared to synthetic drugs, herbal drugs are frequently considered to be less toxic with fewer side effects.[63-66]Therefore; the search for more effective and safer agents exerting immunomodulatory activity is becoming a field of major interest all over the world. Number of plants used in Indian traditional system of medicines for upgrading therapy and chronic diseases has been shown to stimulate immune responses and several active substances have also been isolated. In recent years, immunostimulatory activity has been reported in a number of ayurvedic plants like Withania somnifera, Argyreia speciosa, Tridax procumbens, Ficus benghalensi, Actinidia macrosperma and Tinospora cordifolia etc.[67]

Glycosides from plant and animal sources, upon enzymatic or acid hydrolysis, yield one or more sugar moieties. Numerous glycosides have been shown to exert the desired immunomodulatory action and their structures. Examples include iridoid glycosides (1) Picrorhiza scrophulariiflora and anthraquinone glycosides (2) Andrographis paniculata. Dendroside A and dendronobilosides A and B were found to stimulate the proliferation of murine T and B lymphocytes in vitro, while dendronobilosides B showed inhibitory activity in this same assay[68]. Several types of flavonoids exert immunomodulatory activities; including apigenin, oligomeric proanthocyanidins, isoflavonoids, flavones, and anthocyanidins.[69] such flavonoids are found in Terminalia Arjuna. Saponins are either triterpenoid or steroidal glycosides proven to be essential phytoconstituents with various pharmacological activities, such as antiallergic, antiphlogostic, cytotoxic antitumor, antiviral, immunomodulating antihepatotoxic, molluscicidal, and antifungal activity.[70]

Table 1: List of Plants Having Immunomodulatory Activity[25-60]

Plant Name	Part used	Extract	Model used
Hibiscusrosa sinensis	Flowers	Hydro-alcoholic Extract	Carbon clearance method, Cellular mediated immunity, Immunostimulatory
Cleome gynandra	Aerial parts	Ethanolic extract	Carbon clearance method, Cellular mediated immunity, Immunostimulatory
Trikatu mega	Aerial parts	Pe.Ether, Benzene, Choloroform	Carbon clearance assay, delayed hypersensitivity test
TriAmrit (Termi nalia, Allium, Tinospora)	Aerial parts	Pe.Ether, Benzene, Choloroform	Carbon clearance assay, delayed hypersensitivity test
Nyctanthes arbortristis	Leaf	Ethanolic extract	Humoral immunity, delayed-type hypersensitivity
Cissampelos pareira	Roots	Alkaloidal fraction	Humoral antibody titre
Bauhinia Vareigata	Stem bark	Acetone: water (70:30)	Human Neutrophils
Tinospora Cordifolia	Stems	Ethanolic extract	DTH, Bone marrow cellularity and α-Esterase cells, Zinc sulphate turbidity test.
Balanite Roxburghi	Leaf	Ethanolic extract	Carbon clearance test, serum immunoglobulin
Ficus carica	Leaf	Ethanolic extract	Cellular immune response, Humoral antibody response
Capparis Zeylanica	Leaf	Alcoholic extract	Phagocytosis; Delayed hypersensitivity
Trapa Bispinosa	Fruits	Aqueous extract	Neutrophils, Haemagglutination titre.
Aloe vera	Leaves	Saline extract	Haematological, Serological studies.
Heracleum Persicum	Fruits	Aqueous Extract	Haemagglutination titre, Delayed, type hypersensitivity
Tinospora Cordifolia	Stem	Alcoholic extract	Immunostimulant, macrophase chemotaxis
Ocimum sanctum	Whole plant	Aqueous extract	Enhance the production of RBC, WBC and haemoglobin
Bauhinia variegate	Stem bark	Ethanolic extract	Neutrophil adhesion , Phagocytic activity
Chlorophytum Borivilianum	Roots	Ethanolic extract	In Vivo Phagocytosis Using Carbon Clearance Method
Morus alba linn.	Leaf	Methanolic Extract	Humoral immunity, serum immunoglobulin
Aesculus indica	Leaf	Petroleum ether	Neutrophil index, Neutrophil Adhesion
Ficus benghalensis	Roots	Methanolic extract	Hypersensitivity and hemagglutination reactions.
Citrus aurantifolia	Fruits	Concentrated juice	Cell proliferation assay, Immunoblotting.
Cissampelos pareira Linn	Roots	methanol extract	Humoral antibody titre, Superoxide, Lipid peroxidation.
Tinospora cordifolia	Whole plant	Alcoholic extract	macrophage activation; lysozyme;
Actinidia macrosperma	Whole plant	Aqueous extract	immunomodulator, Sarcoma-180 (S180),
Capparis zeylanica	Leaf extracts	Aerial parts	Immunomodulatory activity; Phagocytosis; Delayed hypersensitivity;
Prunella vulgaris	Fruit-spikes	Aqueous extract	Inhibition of HIV-1 reverse transcriptase activity
Rhaphidophora korthalsii	Leaf extracts	Methanolic Extract	In vitro splenocyte cytokine (IL-2, IL-12 and IFN-γ) Determinations, In vitro Splenocytes, thymocytes and bone marrow cell viability assay.
Sellaginella species	Whole plant	Powdered in gum Acacia	Immunomodulatory, short term toxicity.
Couroupita guinensis	Flowers	Pet. ether, Benzene, Choloroform, Ethyl acetate, 70% ethanol and water	Allergic reaction, Haemagglutination
Aesculus indica	Leaf	Petroleum ether and ethanol	Haemagglutination antibody
Capparis zeylanica	Aerial part	Methanolic and aqueous extracts	Haemagglutination antibody titre
Aloe vera	Leaves	Powder dissolved in Phosphate buffer solution	Humoral antibody response to SRBC,Cellular immune response (Foot pad reaction test)
Actinidia macrosperma	Whole plant	Aqueous extract	AM induced antitumor
Allium sativum	Whole plant	Hydro-alcoholic Extract	Hemagglutination
Andographis paniculata	Whole plant	Andrographolides Extract	Delayed type hypersensitivity (DTH) mouse model
Asparagus racemosus	Root	Aqueous extract	SRBC sensitized animals
Baliospermum Montanum	Root	Aqueous extract	Nitro blue tetrazolium test
Boerhaavia diffusa	Whole plant	Hydro-alcoholic Extract	Circulating antibody titer
Caesalpinia bonducella	Seed	Ethanolic extract	Neutrophil adhesion test, Haemagglutinating antibody (HA)
Curcuma longa	Balb	Hydro-alcoholic Extract	Humoral antibody response to SRBC
Eclipta alba	Whole plant	Methanolic extracts	phagocytic index and antibody titer
Epilobium angustifolium	Whole plant	Hydro-alcoholic Extract	Chemotaxis, NF-kappa B activation
Mangifera indica	Stem bark	Alcoholic extract	Humoral antibody response to SRBC
Picrorhiza kurroa	Leaf	Ethanolic extract	Cell-mediated and humoral components
Salicornia herbacea	Whole plant	Hydro-alcoholic Extract	Phagocytic activity on opsonised
Withania somnifera	Root	Alcoholic extract	Bone marrow cellularity
Azadirachta indica	Leaf	Hydro acetone Extract	WST-1-based cytotoxicity assay
Boswellia carterii	Bark	Methylene chloride extract	Reagents for lymphocyte transformation assay
Gymnema Sylvestre	Leaves	Water extract	Neutrophil locomotion and chemotaxis test
Tridax procumbens	Aerial part	Alcoholic extract	delayed-type hypersensitivity (DTH) model

Recently, three diosgenyl saponin isolated from Paris polyphylla have been reported to have Immunostimulant properties. Sapogenins, such as triterpenoid saponins and diterpene exert a wide range of immunomodulatory activities. Examples are Gymnema sylvestre, Chlorophytum borivilianum, Boswellia spp. and Randia dumetorum.[71-73]

Various plant constituents with terpene moiety exhibit immunomodulatory activity, e.g., eugenol from Ocimum sanctum, diterpene from Andrographis paniculata, Achillea millefolium, Alternanthera tenella, and triterpenes from Ganoderma lucidum, lupeol and amyrine in Bauhinia variegate. phytochemical analysis of medicinal plants has revealed a large number of compounds including tannic acid, flavonoids,tocopherol, curcumin, ascorbate, carotenoids, polyphenols, etc., which have been shown to have potent immunomodulatory properties.[74] Some medicinal plants may stimulate the immune system, (e.g., Panax ginseng, Ocimum sanctum, Tinospora cordifolia, and Terminalia arjuna), and some may suppress the immune response (Alternanthera tenella). Also, various secondary metabolites (e.g., alkaloids, glycosides, saponins, flavonoids, coumarins, and sterols) exhibit a wide range of immunomodulating activity.[75]

CONCLUSION

The immune system is complex organ high specialized cells and even circulatory separate from blood vessels. Organ and the tissues of the immune system dot the body in a protective network of barrier to infection. Innate and adaptive immunity depends on the activity of white blood cells. Innate immunity largely depends upon granulocytes and macrophages, while adaptive immune response depends upon lymphocytes, which provide long term immunity. Immunomodulation is the ruling of immune responses by stimulating them to prevent transmittable diseases or by suppressing them in the undesired circumstances. Many proteins, amino acids, and natural compounds have shown a significant ability to regulate immune responses, including interferon-γ (IFN-γ), steroids, DMG. Plants have been used since ancient times for the treatment of various diseases and disorders. The few herbal plants have been discussed which are previously explored by the various researchers for their immunomodulatory activity. Several medicinal plants exhibit not only immunomodulatory activity but also a wide range of antioxidant, antiasthmatic, antiarrhythmic, antiinflammatory, hepatoprotective, hypocholesterolemic, antifungal, cardiotonic, diuretic, and other medicinal activities. Immunodeficiencies occur when one or more of the components the immune system are inactive. It included autoimmunity, hypersensitivity and HIV etc. New immunomodulatory plants are important for the discovery of drug with fewer side effects, less costly, more potent and effective treatment developed for immune and their related diseases. Herbal medications are free from side effects and toxicity unlike the allopathic medicines. This type of study with immunomedicinal herbs will contribute to the benefit of the populations needing herbal treatment to treat immune diseases without being used of synthetic drugs and prevent or reduces the side effect of synthetic drugs.

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