



Immunomodulatory activity of brahmarasayana: An empirical review

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Abstract

Rasayana is one of the Ayurveda's eight scientific specialties. The Rasayana therapy improves Rasa's properties, improves it with nutrients, so it is helpful as durability, memory, wisdom, body and sense organs optimum growth. Brahma Rasayana is one of the most influential texts of the Ayurvedic Rasayana. It is beneficial for enhancing the body's memory and immunity. It was observed that Brahma Rasayana greatly stimulates antibody-dependent cytotoxicity. For the screening of herbs (ingredients) of Brahma Rasayana, the present analysis is carried out in order to determine their immunomodulatory properties and create a link between Rasayana and the immunomodulatory effect. To explain their immunomodulatory property on the basis of data gathered, a comprehensive analysis of herbs to illustrate immunomodulatory property is compiled from various Ayurvedic texts as well as from several publications in the literature. As per Ayurveda, several of the herbs examined by Brahma Rasayana have been found to serve as immunomodulators. This illustrates their ability to serve as a property of antioxidant, anti-stress, anti-inflammatory, anti-bacterial, vaccine adjuvant, or disease immunity. Of all herbs examined in the current report, the ingredients of the Brahma Rasayana formulation were found to show immunomodulatory effects of the formulation.

Keywords: formulation, herbs, immunomodulators, rasayana

Introduction

The term "Rasayana" consists of two words: "Rasa" and "Ayana." [1] "Rasa" primarily means seven vital tissues, also called Saptadhatu, that are important. Rasa, Rakta, Mansa, Meda, Asthi, Majja, and Shukra are part of Saptadhatu. The road or channel means the word "Ayana". Rasayanas are therefore those that bring about the proper absorption, growth, and enhancement of essential Dhatus [2]. The term Rasayana then refers to Rasa (nutrition) and its transportation through the body. Rasayana is a health-promoting and rejuvenating agent that both physically and psychologically produces resistance to disease through its scientific effects. Via a dramatic improvement in total leukocytes, Brahma Rasayana enhanced the regeneration of the haemopoetic system. It is a condition of enhanced diet that contributes to a variety of secondary characteristics, such as ageing and longevity protection, disease tolerance, mental competence and increased body stamina [3-5].

One of the most useful Ayurvedic formulas made with 45 herbal ingredients is Brahma Rasayana, which claims to boost intellect, memory, and immune capacity and to be used against stress and fatigue. For the treatment of drowsiness, exhaustion, lethargy, exhaustion without exertion, mental impairment, senility, progeriasis, ageing, and disrupted memory, Brahma Rasayana is listed in "The Ayurvedic System of India". This formulation is very critical [6].

It is claimed that Rasayana medicines slow down the mechanism of ageing (jara) and offer a buffer against diseases (vyadhi). Rasayana enhances an individual's host resistance, helping to suppress ageing and diseases. In Rasayana therapy, unique diets and lifestyle changes are also recommended. The immune system works on Rasayana medications. The immune system has relations with a

variety of other organs and may affect the actions of several other organs directly or indirectly. By working on the immune system, Rasayana illustrates different actions on other tissues [5].

An immunomodulator is a treatment that is used because of its effect on the immune system. It can be characterised as a substance that, in a specific or non-specific way, can affect any part or function of the immune system. In Ayurveda, the principle of immunomodulation is mentioned as Rasayana. Ayurveda has two goals: one is to discourage and encourage health, and the other is to treat illnesses [7].

The term immunomodulation implies a shift in the immune response that can increase or decrease the response of the immune system. Immunomodulators may be described as a material capable of activating, suppressing, or modulating any immune system, including both the endogenous and adaptive immune response weapons. Immunomodulators are known to be one of the most potent methods throughout prevention and disease control. Scientific experiments have now become the focus of regulation of the immune system by using Ayurvedic herbal medicines as a potential therapeutic measure. Immunosuppressive and immunostimulative agents are used as natural adjuvants, synthetic agents and antibody reagents [7].

Concept of immunity as per Ayurveda

The definition of immunity was propounded by Ayurveda as "Vyadhikshamatwa." In Ayurvedic drugs, one of the medicinal techniques is to improve the total natural resilience of the body to the disease causing agent rather than neutralising the agent itself directly. A driving philosophy in Ayurveda has been the use of herbs to strengthen the general resilience of the body to certain diseases and pathogens [3].

Main Text

Modern concept of immune system

The body's protection against infectious agents and other pathogens is the immune system. The immune system targets pathogens and chemicals that enter body structures and induce disease in a step-step called the immune response. A network of cells, muscles, and organs that function together to protect the body is made up of the immune system. The master of the human immune system is a lymphocyte. Morphologically, lymphocytes are homogeneous, but they function in a heterogeneous manner. There are three types of lymphocytes-T-lymphocytes, B-lymphocytes, and Natural Killer (NK) cells. Both three lymphocytes are produced from bone marrow lymphoid precursor cells, which are further matured and differentiated in the bone marrow (B-cells) and thymus (T-cells) [8].

The immune system is defined as a diverse and highly developed interconnected body system network, including organs, tissues, cells, and cell products, with a mission to physiologically provide resistance and/or retaliation against foreign agents or invaders. The immune system contains multiple organs or tissues, such as the principal lymphoid organs such as the thymus and bone marrow, whilst spleen, tonsils, lymph arteries, lymph nodes, adenoids, skin and

liver are the secondary lymphoid organs [8]. An immunomodulator may be identified as a material that can have a specific or non-specific effect on any part or feature of the immune system, including either the innate or adaptive arms of the immune response. They are a complex variety of recombinant preparations, synthetic and natural, mostly cytokines. Many of these drugs are now approved for use in humans, such as granulocyte colony-stimulating agent, interferon, imiquimod, and cell membrane fractions from bacteria. Others, including interleukin and separate chemokines, phosphate-guanosine synthetic cytosine, oligodeoxynucleotides, and glucans, are currently being thoroughly studied in clinical and pre-clinical trials. Immunomodulatory regimens provide an appealing alternative because they also have fewer side effects, and less risk for susceptibility to infectious pathogens, than established medications [8,5].

Active chemical constituents of Brahma Rasayana

Brahma Rasayana has 45 ingredients, as mentioned above, and many of them have very significant immunomodulatory properties. The immunomodulatory properties of the Brahma Rasayana components below have been tabulated:

Table 1: Active chemical constituents of Brahma Rasayana.

Components of the Brahma Rasayana	Immunomodulatory properties
Amalaki (<i>Emblica officinalis</i>)	It stimulates polymorphonuclear (PMN) cells and RE system and also enhances NK cell and antibody-dependent cellular cytotoxicity (ADCC). [9]
Haritaki (<i>Terminalia chebula</i>)	It has immunomodulatory effect on cell-mediated and humoral components of the immune system. Due to its wound healing property and as antiasthmatic it increases HA titer and delayed-type-hypersensitivity (DTH) reaction. [10]
Bilva (<i>Aegle marmelos</i>)	Its methanolic extract effectively stimulated cell-mediated and antibody-mediated immune response than ethanolic extract. [11, 12]
Agnimanth (<i>Clerodendrum phlomidis</i>)	Oral administration of methanol extracts of <i>C. phlomidis</i> root has significantly increases in hemagglutinating antibody titer. [11, 12]
Shyonak (<i>Oroxylum indicum</i>)	The <i>n</i> -butanol extract of <i>O. indicum</i> attenuate the stress-induced immunosuppression through antioxidant mechanism. [11, 12]
Patala (<i>Stereospermum suaveolens</i>)	Phytochemical analysis of <i>S. suaveolens</i> root extract (SSRE) showed the presence of flavonoids, terpenoids, saponins, alkaloids, tannins, carbohydrates, steroids, and gums. [11, 12]
Gambhari (<i>Gmelina arborea</i>)	The plant shows the presence of flavonoids (apigenin), which is reported to exhibit immunomodulatory activity [11, 12].
Shalparni (<i>Desmodium gangeticum</i>)	<i>D. gangeticum</i> possesses a strong antioxidant activity, which might be responsible for its anti-arthritis activity. [11, 12]
Kantakari (<i>Solanum xanthocarpum</i>)	<i>S. xanthocarpum</i> have protected the animals in <i>in vivo</i> experiments against CP-induced immunosuppression indicating its profound immunomodulatory activity. [11, 12]
Gokshura (<i>Tribulus terrestris</i> [TT])	The saponins obtained from TT enhance the phagocytic efficacy (increased activities of macrophages, T-lymphocytes, and B-lymphocytes of the PMN cells by causing more engulfment of the yeast cells, thereby stimulating a non-specific immune response. [11, 12]
Bala (<i>Sida cordifolia</i>)	<i>S. cordifolia</i> root possess anti-stress, adaptogenic, analgesic, anti-inflammatory, hypoglycaemic and hepatoprotective activity. [11, 12]
Punarnava (<i>Boerhavia diffusa</i>)	The root of <i>B. diffusa</i> (Punarnava) has anti-inflammatory, anti-stress, adaptogenic, and antiaging property which inhibits production of NO, IL-2 and IL-7, and tumor necrosis factor-alpha (TNF- α). [11, 12]
Erand (<i>Ricinus communis</i>)	The immunomodulatory activity may be due to the presence of tannins in the <i>R. Communis</i> . [11, 12]
Jivanti (<i>Leptadenia reticulata</i>)	It exhibits immunostimulatory effects by enhancing antibody titer and phagocytosis. Its stem extract has tonic or antiaging property which is used as anti anaphylactic effect on mast cell degranulation. [11, 12]
Satavari (<i>Asparagus racemosus</i>)	Aqueous extract of <i>A. racemosus</i> acts as a potential antioxidant by decreasing lipid peroxidation and increasing glutathione content. It also acts as an immunomodulator by increasing the activity of macrophages and proliferation of lymphocytes. [11, 12]
Kusha (<i>Desmostachys bipinnata</i>)	The hydroalcoholic extract of root has <i>in vivo</i> and <i>in vitro</i> H ₂ O ₂ radical scavenging assay. [11, 12]
Kasa (<i>Saccharum spontaneum</i>)	The methanolic extract of root has thiocyanate, DPPH, NO radical scavenging, reduction potential. [11, 12]
Darbha (<i>Imperata cylindrica</i> [ICL])	The methanolic extract of root has hydrogen peroxide and NO scavenging activity. [11, 12]
Ikshu (<i>Saccharum officinarum</i>)	Phenol-rich fraction of <i>S. officinarum</i> exhibits immune-stimulatory effect by enhancing the phagocytic activity of peripheral blood leukocytes. [11, 12]

Twak (<i>Cinnamomum zeylanicum</i>)	<i>C. zeylanicum</i> essential oil and bark extract exhibit significant antioxidant activity and it has appreciable immunostimulatory activity. [11, 12]
Ela (<i>Elatteria cardamomum</i>)	Higher concentrations of extract of cardamom may impede macrophage pro-inflammatory responsiveness. [11, 12]
Haridra (<i>Curcuma longa</i>)	Anti-cancer properties of curcumin may be mediated, at least in part by inhibition of inducible form of NO synthase. It is also an anti-alzheimer's agent. It also acts as HIV-1 and HIV-2 protease inhibitor, hepatoprotective, hypoglycemic and hypolipidemic agent. [11, 12]
Pippali (<i>Piper longum</i>)	It increases total WBC count, bone marrow cellularity and total antibody production. It has immunomodulatory and anti-inflammatory activities by suppressing the pro-inflammatory cytokines. It can also act as a bio-enhancer and anti-tumor agent. [11, 12]
Chandana (<i>Santalum album</i>)	Sandal wood oil had a dose-dependent effect against HSV-1. [11, 12]
Mandukaparni (<i>Centella asiatica</i>)	The water extract of <i>C. asiatica</i> exert immunostimulating activity thereby increasing the phagocytic index and total WBC count. [11, 12]
Sankhapushpi (<i>Convolvulus pluricaulis</i>)	It has scientific potential for CNS depression for its anxiolytic, tranquillizing, antidepressant, antistress, neurodegenerative, anti-amnesic, antioxidant, hypolipidemic, immunomodulatory, analgesic, antifungal, antibacterial, antidiabetic, antiulcer, anticatatonc and cardiovascular activity. [11, 12]
Vacha (<i>Acorus calamus</i>)	It stimulate the neutrophils phagocytic activity and is a proven anti-inflammatory, hepatoprotective, antibacterial, antiulcer and anti-oxidant agent. [11, 12]
Yashtimadhu (<i>Glycerrhiza glabra</i>)	The bark and root of <i>G. Glabra</i> has immunomodulatory activity in cellular arm response (cellular immunity), phagocytic response and anaphylactic reaction. [11, 12]
Sugar (<i>S. officinarum</i>)	It possesses immunostimulatory, anti-thrombosis, anti-inflammatory, vaccine adjuvant, anti-oxidant, modulation of acetylcholine release and anti-stress activities. [11, 12]
Madhu (<i>Honey</i>)	It induces the production of pro-inflammatory cytokines IL-1 β and TNF- α . [11, 12]
Ghrita (<i>Clarified butter</i>)	Ghee contains conjugated linoleic acid which has been shown to reduce the formation of inflammatory mediators such as LT, prostaglandin and ILs. [11, 12]

From the above table, it is clear that there are several active components within the Brahma Rasayna and all possess immunomodulatory properties. Majority of the active components within the Brahma Rasayna modulate the active immune system of a person. Some of the components possess anti-stress, adaptogenic, analgesic, anti-inflammatory, hypoglycaemic and hepatoprotective activity. Not only these, Brahma Rasayna has promising antidiabetes and antihepatotoxicity properties. It can be employed as safe memory enhancer and for effective treatment for hepatotoxicity or liver damage.

Oxidative stress is the secondary factor of most human infections, since, for example, activated neutrophils produce O², H₂O₂ and HOCl to kill pathogens. They will cause tissue damage if a large number of phagocytes are triggered in a concentrated location. For eg, synovial fluid from rheumatoid arthritis in the sole and knee joints includes a significant amount of activated neutrophils. Oxidative stress can cause some human diseases. For example, free radical damage to protein, DNA and lipids is caused by excess radiation to the biological system. Neurological conditions are mediated by oxidative stress by the nutritional disparity in tocopherol. Intracellular free Ca²⁺ damage to membrane ion transporters and other unique proteins and lipid peroxidation is also caused [13, 15, 16]. The immune system has relations with a variety of other organs which may control the actions of these organs directly or indirectly. The immune system's job is to safeguard our bodies from foreign invaders. It plays a crucial function in the pathogenesis, autoimmunity and allergy of immune-deficient diseases [14, 16, 17].

Therefore, enzymes are produced to guard against damage to cells, or by ingestion of free radical scavenger substances are known as antioxidants to neutralise or detoxify free radicals. Thus, there is disparity between free radical diseases and the subsequent anti-oxidant diseases. Two forms of antioxidants are known to be helpful against pathogenesis in biological systems; they are endogenous and exogenous antioxidants. Brahma Rasayana includes

antioxidants that are both endogenous and exogenous. Immunity was defined in Ayurveda in the form of Vyadhikshamatva by Acharya Charaka. Ayurveda states, is what treats the illness and also offers physical, mental and social wellbeing [18-24]. The Rasayana therapy greatly improve all lymphocytes and neutrophils [25].

Conclusion

According to Ayurveda, pure treatment is that which cures the disease and also provides physical, mental as well as social health. Rasayana are health promoting and rejuvenating agents which by their empirical effects produce resistance against disease both physically and mentally. Brahma Rasayana accelerated the recovery of the haemopoetic system by a rapid rise in total leukocytes. Both lymphocytes and neutrophils were significantly increased by Rasayana treatment. Bramhrasayana possess the traditional polyherbal formulation which is widely used as tonic, rejuvenator, anabolic, immunomodulator and memory enhancer. Bramhrasayana manifests the entire human quest for immortality, freedom from disease and prevention of aging. Thus, it is seen here that immunomodulatory properties are present in the components found in Brahma Rasayana. Brahma Rasayana is also found on the basis of this disease-resistant or immunomodular land. It is in itself an essential Rasayana. In the analysis of each drug, several of these substances were shown to have immunomodulatory properties. They have been found to be good for physical and mental wellbeing and to be able to tackle diseases at the same time.

Future perspectives

Brahma rasayana has potential in amelioration of radiation induced damage. Administration of Brahma rasayana is known for significant increase in Bone marrow cellularity, serum level of interferon- γ (IFN- γ), interleukin-2 (IL-2), and granulocyte macrophage-colony stimulating factor (GM-CSF) and α -esterase positive cells within radiation-treated study subjects. In cancer Treatment, Brahma rasayana is

known to display radioprotective effects. Also, it helps to identify the maximal permissible dose for optimal radioprotective effects. Brahma rasayana formulations should also be used as a radiation countermeasure agent in the management of nuclear incidents, for example, for the protection of defense personnel from nuclear weapon radiations, for protecting reactor workers and rescue crew, and protection of astronauts from cosmic rays against radiation-induced genomic instability and carcinogenesis. The Ministry of AYUSH by the Government of India has introduced measures to manage the outbreak of COVID-19. Mass prophylaxis measures through Brahma Rasayan should be assessed for predominant effect on respiratory tracts on exposed but asymptomatic (Quarantined) COVID-19 individuals.

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