Immunity Explained and How to Boost it

Sandra Kaufmann, MD
J. Cerny… Contributing editor

Introduction

Our immunity network is a very complicated and evolved system that prevents harmful organisms from gaining entry into our bodies and having consequential, detrimental effects. The system is usually broken down into two components, the innate and the adaptive. The innate system allows us to fend off pretty much any pathogen in a very non-specific fashion. The adaptive, or learned system, allows the body to remember past pathogens and present a stronger defense the second time around.

Our innate system is composed of cells that are programmed to recognize non-specific foreign substances and to react accordingly. Important components of this limb include the natural killer cells, mast cells, eosinophils, basophils and the phagocytic cells. The latter can be broken down into macrophages, neutrophils, and dendritic cells, and work by engulfing and then destroying pathogens.

The adaptive immune system, meanwhile, focuses on recognition of previously experienced pathogens. This explains why we generally have immunity against pathogens after an initial infection and why vaccines are effective.

The cells in this division are the lymphocytes, i.e. B cells and T cells. B cells, derived from the bone marrow and produce antibodies. T cells, which mature in the thymus, and then differentiate into cells that either participate in lymphocyte maturation, or kill virus-infected cells.

When thinking about the molecular agents that can be useful, we can think about them in the following categories.

The innate system

Lymphocytes

These are the cells that can non-specifically recognize pathogens. The natural killer cells are critical components here, in that they provide significant resistance against viruses, bacteria, fungi and parasites.

Cytokine Production

Cytokines are molecules that are produced and exuded by cells and can mediate cell-to-cell communication. These molecules are obviously very useful, but they can also be extremely detrimental when they precipitate extreme reactions in response too pathogens, which is what happens in sepsis or hemodynamic collapse. Common cytokines include Il-1, IL-2, TNF-α, NF-KB, IFN-γ, IL-4, and IL-5.

The adaptive system

Lymphoblastogenesis

There are many important types of cell in this category, but the two crucial types are T and B cells. The B cells produce immunoglobulins, while T cells help to destroy the pathogen. There are many subtypes within each of these cell categories, but we don't need that much detail for this discussion.

Immunoglobulin (Ig) production

The B cells, as noted above, are responsible for the production of immunoglobulins. These come in several shapes and sizes; for example, IgG, IgM, and IgA. The exact type is determined by the body location and the specific pathogen.

The agents

Below is an eclectic assortment of plants and molecules from around the world that have known immunomodulatory activity. It does not include many of the more common agents, as many people are already familiar with, like Vitamin C and Zinc for example. In no way is this list complete, nor should anyone expect to have complete protection from any pathogen with these agents. These should, however, decrease the relative risk of acquiring any pathogen-derived illness, and may diminish any symptomatology.

Astaxanthin

Astaxanthin, a carotenoid and a xanthophyll, is related to zeaxanthin and canthaxanthin and is a lipid-soluble red-orange pigment.

Several organisms can make it, but it is generally produced naturally by the freshwater microalgae *Haematococcus pluvialis*. When this algae is stressed, by either a lack of nutrients, increased salinity, or excessive sunshine, it creates astaxanthin. This pigment provides the red color in most marine life, including salmon, red trout, flamingos, shrimp, krill, crab, lobster, and crayfish.

Astaxanthin can also be used as a dietary supplement intended for human, animal, and aquaculture consumption. The U.S. Food and Drug Administration has approved astaxanthin as a food coloring (or color additive) for specific uses in animal and fish foods.

This remarkable molecule, in addition to providing positive anti-aging and health benefits, can help boost both arms of your immune system.

In mice, cat and dog models, astaxanthin has been found to improve the antibody response with increases in both IgG and IgM. Treated mice demonstrated an increase in cytotoxic T activity, while cats demonstrated an increased number of CD3 and CD4 T cells. Meanwhile, dogs demonstrated improved natural killer cell activity and an increased B cell population.

Human cell cultures, as well, saw an enhancement of the immunoglobulin response in addition to more active neutrophil phagocytic activity. Furthermore adult women treated with astaxanthin demonstrated improved mitogen-induced lympho-proliferation, increased natural killer cell cytotoxic activity and increased total T and B cell subpopulations.

Meanwhile, a study of adult male athletes demonstrated an improved IgA response. This is key as IgA immunoglobulins patrol mucous membranes and prevent entry of pathogens into the body.

Cistanche Deserticola

Cistanche deserticola is a holoparasitic member of the plant family Orobanchaceae, which means that the plant pretty much acquires all of its requirements from some other plant. In fact, it lacks any chlorophyll at all, and mooches everything from the saxaul plant. Despite these limitations, *Cistanche deserticola* is the noted source of the Chinese herbal medicine cistanche, commonly called Rou Cong Rong.

Cistanche is naturally found in Inner Mongolia where the annual production is about 70 tons. The stems are gathered in the spring, dried in the sun and then cut into slices for medicinal use. Unfortunately, *Cistanche deserticola* has been deemed an endangered species, but it has not yet been banned from trade. Thus, we need to use it wisely.

This little known, but powerful plant possesses broad medicinal functions, especially for use in immunomodulatory, neuroprotective, anti-oxidative, anti-nociceptive, and anti-inflammatory situations.

Much like astaxanthin, cistanche stimulates the proliferation of antibodies, especially IgG, but it is also known to increase the number of CD4+T and CD8+T cells.

In a mouse model, it had been shown to activate the phagocytic function of macrophages.

Lastly, when administered contemporaneously with vaccines, especially seasonal influenza vaccines, there seems to be an enhanced reaction, making the vaccine more effective.

Nigella sativa

Nigella sativa, also known as black seed oil, black caraway and black cumin, is an annual flowering plant in the family Ranunculaceae, native to the Indian Subcontinent and West Asia.

Nigella has been around for a very long time, and in fact Nigella seeds were discovered in several sites from the ancient world, including Tutankhamun's tomb as well as in a Turkish Hittite flask from the second millennium BCE.

The plant is known to be anti-inflammatory, anticancer, antibacterial, anti-microbial, antidiabetic, hypolipidemic, and anti-histaminic. For our purposes, Nigella is also immunomodulatory.

Treated rabbits demonstrate an increase in IgG and IgM, while sheep demonstrate increased macrophage activity. Mice, meanwhile, see an increased number of macrophages and CD4 helper T cells.

There is also evidence that Nigella can treat many viruses. There is evidence for this against Cytomegalovirus infection in mice, Hepatitis C in humans, influenza in turkeys and Newcastle disease in chickens.

The other interesting thing about Nigella is that it is good for the lungs. Two of the more important component oils are Nigellone and Thymoquinone, which are powerful bronchodilators, and the plant can more expediently restore lung function.

Shilajit

Shilajit, a.k.a. mumijo, is a blackish-brown exudate obtained traditionally from high mountain rocks in the Himalayas, and also from the mountains of Afghanistan, Nepal, Bhutan, Pakistan, China, Tibet and Russia. This exudate consists of a complex mixture of organic humic and plant substances as well as microbial metabolites. The major physiological action is thought to be due to the bioactive dibenzo-alpha-pyrones along with humic and fulvic acids.

Despite the oddity of consuming rock ooze, the use of Shilajit is very old, with references dating to the 6th century BC, when it was thought to cure all diseases of the body. In fact, Shilajit actually means the ‘conqueror of the rocks’ and ‘destroyer of the weaknesses’.

Shilijat is known to promote both health and longevity in general, but it is also endowed with both immune boosting and viral-load reducing properties.

In a mouse model, treated animals demonstrated an increased T cell proliferation, an increase in immunoglobulin levels, and increased activity of the macrophage population.

In human cell cultures, Shilajit exhibited a dose-dependent inhibitory activity against several key viruses, including Herpes Simplex type 1 and 2, Human Cytomegalovirus, Human Respiratory Syncytial virus and Hepatitis B.

Isatis indigotica

Isatis indigotica, a.k.a. woad, is a flowering plant in the family Brassicaceae, native to the steppe and desert zones of Central and Western Asia, and Eastern Siberia.

The most ancient of our agents, woad seeds date back to the Neolithic Era. Impressions of the seeds have been found on Iron Age pottery, while the Egyptians used it to dye fabric for mummy wrappings. In medieval days, it was an important source of blue dye and thus was cultivated throughout Europe.

Aside from the color enhancing aspects, *Isatis indigotica* root has been used medicinally in China for nearly two thousand years. More recently, it was used in the war against SARS in China, Hong Kong and Taiwan.

Historically the medical indications for its use were high fever, scarlet fever, mumps, pharyngitis, chicken pox, measles, hepatitis, cold and flu, pneumonia, and shingles.

More modern studies have documented improvements of the immune system, as well as confirming its antibacterial and antiviral benefits. Specifically, it has been found beneficial in the treatment of influenza, viral pneumonia, Hepatitis A and Japanese encephalitis.

In cell culture, *Isais indigotica* root extract was found to be effective against some human and avian influenza viruses, specifically H1N1 and H3N2. Based on the study, the researchers hypothesized that the extract physically attaches to the viral particle and prevents the binding of the influenza virus to the host cell surface.

In another study, Clemastanin B, thought to be one of the more active components, demonstrated anti-influenza activities against H1N1, and Herpes Simplex type 1 and 2. Meanwhile, the polysaccharide component of the root demonstrated positive effects on swine lymphocytes in culture.

Iariciresinol-4-O-β-D-glucopyranoside, another active component, was tested on a human alveolar epithelial cell line against Influenza A. Whereas this agent did not prevent the cell from becoming infected, the pro-inflammatory cytokine cascade was significantly decreased.

Quercetin

Quercetin, a plant flavonol and polyphenol, is found in many fruits and vegetables, including red onions and kale. It is foremost known to be a mast cell stabilizer, which is useful when activated mast cells release too much histamine. Thus, it is used frequently in the treatment of asthma and allergies. More recently, it was identified as a senolytic agent, able to eradicate senescent cell and promote longevity. In addition, quercetin has significant immune-modulating properties.

In a mouse model, quercetin stimulated the production of IgG and positively affected the macrophages. It also reduced rhinovirus-induced expression of pro-inflammatory cytokines and lung inflammation.

As well, in human mast cell cultures, quercetin inhibited the enzymes required for viral entry into the cells, in addition to the enzymes necessary for viral replication.

In cell cultures, quercetin reduced the infectivity of target cells and the rate of viral replication against a wide variety of respiratory viruses including Herpes Simplex type 1 and 2, certain Adeno viruses, Coronavirus, Parainfluenza virus type 3, Respiratory Syncytial virus, and Rhinovirus.

In fact, quercetin has proven antiviral activity against a wide range of viruses, including H1N1, Dengue - 2, ZIKA, and Ebola.

Final thoughts

To reiterate, in no way does this list cover all of the molecular agents known to boost the immune system. It does however, highlight some of the more interesting options that are available from around the globe and throughout history. From Himalayan rocks to algae to plants found in King Tut's tomb, there are innumerable well-tested and well-traveled solutions to today's challenges.