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Minerals and Immune Function

An Introduction to the Immune System

Every day our immune systems perform an extraordinary task and that is keeping us safe from infections and illnesses caused by the germs, microorganisms, and viruses that one is exposed to constantly. Nutrition, and more specifically, minerals and trace elements play an important role in immune function and health. Sufficient intakes of minerals and trace elements are needed for the immune system to function properly. However, dietary intake studies (not just in the U.S. but worldwide) show that the majority of individuals don't meet the recommended dietary intakes for magnesium and select trace elements. People who are deficient or have low levels of certain minerals (magnesium, zinc, selenium, trace elements) may be at risk for impaired immune function.

The immune system is made up of a vast and highly complex network of cells, tissues and organs that all work in unison all of the time to protect the body from harm. What kind of harm? Whether it is a cut on the finger (which can allow dangerous bacteria to enter the body through the skin) or if a virus or bacteria is able to enter the body and begin replicating quickly, if an individual has impaired immunity, the body's natural defenses could quickly be overwhelmed, which could result in serious infection, illness, and even death.

Immunity is the body's ability to effectively defend against antigens—those foreign invaders be they viruses, bacteria, or even cancer cells that are constantly trying to undermine one's health. But, in order for the immune system to function as it should, it must be able to distinguish its own cells and tissue versus antigens and material that are incessantly introduced into the body from the environment.

The Three Types of Immunity—Innate, Adaptive, and Passive

It's no easy task to explain immune function in a few condensed paragraphs. There are three types of immunity—innate, adaptive, and passive. Each person is born with **innate immunity**, which is a type of general protection all individuals have. For instance, the external barriers like the skin and mucous membranes (the lining of the nasal passages, throat, etc.) provide the first line of defense against invading antigens. **Adaptive immunity** is immunity that develops over one's lifetime as one is exposed to different illnesses or disease or if one is immunized against certain diseases like polio, diphtheria, or chicken pox. **Passive immunity** is immunity one "borrows" temporarily from another

source. Newborns and infants, for instance, obtain antibodies in their mother's breast milk, which helps protect them from diseases the infant's mother has been exposed to.

Immune Disorders

Sometimes, though, the immune system doesn't function as it supposed to or there may be certain disorders that prevent the immune system from functioning properly. **Immunodeficiency diseases** can occur if the immune system isn't working as it should. Sometimes a person can be born with an immunodeficiency or it can show up later in life the result of an infection or medication or medical treatments (chemotherapy, for instance, kills both cancer and healthy cells), etc. HIV (or Human Immunodeficiency Virus)/AIDS (Acquired Immune Deficiency Syndrome) is perhaps one of the most well known immunodeficiency diseases. HIV attacks the lymphocytes (more on that in a minute) until they are destroyed. During the latter phase of HIV, the individual's immune system becomes impaired and the individual succumbs to infections and illnesses. **Autoimmune disorders** occur when the body, for some unknown reason, attacks its own cells and tissue. Some well known autoimmune disorders include juvenile RA (rheumatoid arthritis), lupus, psoriasis, scleroderma, and others. **Allergies** including eczema, asthma, and seasonal allergies, occur when the immune system hyperreacts to antigens. Certain **cancers** are characterized as disordered immune function. Lymphatic cancer, which involves the lymph tissues, and leukemia are two common childhood cancers.

So, how does our immune system work? As was discussed earlier, the immune system is made up of a complex network of cells, tissue, and organs. White blood cells or **leukocytes**, that include two sub-types, **phagocytes** and **lymphocytes**, are constantly seeking out antigens or microorganisms that cause disease or illness. **Phagocytes** attack invading organisms. **Lymphocytes** allow the body to recognize and "remember" previous invaders and then help to wipe out these invaders.[1]

Lymphocytes originate in the bone marrow from stem cells, and there are basically two types of lymphocytes. **T-lymphocytes** originate in bone marrow, but eventually migrate to the thymus. **B-lymphocytes** mature in bone marrow and stay there. Lymphocytes enter the blood stream and become lodged in tissues and organs like the spleen, lymph nodes, tonsils where they are encased in a delicate network of connective tissue. This system directs lymphocytes so they come into direct contact with antigens. Lymph fluid that is drained from lymph tissue found throughout the body is pumped to the blood through lymphatic vessels. Lymph nodes distributed along these vessels filter the lymph exposing antigens to the lymphocytes. [1]

When an antigen has entered the body, the B lymphocytes will identify the antigen and, through different reactions, will produce antibodies (immunoglobulins) that are proteins that lock onto the antigen. These antibodies remain in the body in case the same antigen is introduced again. After binding to an antigen, antibodies then initiate **complement**. And, from there, a complex cascade of events occurs that work together in killing bacteria, viruses, or infected cells.[2] But it is the T lymphocytes that are the ones who destroy the antigens or infected cells. T cells also communicate or signal other cells like phagocytes to vanquish the invaders.

The Influence of Nutrition on Immunity

Nutritional status has a well known impact on immune function. Poor nutrition, which includes not receiving adequate amounts of minerals, micronutrients, and vitamins, is associated with suppressed immune function. Minerals (both their lack of and adequate intakes) such as magnesium and trace minerals including zinc, copper, and selenium have been researched and are known to impact immune health. According to one study published in 2007, "Micronutrient deficiency suppresses immune functions by affecting the innate T-cell-mediated immune response and adaptive antibody response, and leads to dysregulation of the balanced host response.," [3]

The elderly, pregnant or women who are breastfeeding, as well as individuals who smoke, suffer from alcoholism, or who have an eating disorder or a chronic disease are all at risk of micronutrient deficiency.[3]

Magnesium

Magnesium is involved in immune function, both in innate and acquired immune response according to researchers.[4] According to Leo Galland, magnesium acts as a cofactor for immunoglobulin synthesis, immune cell adherence, antibody-dependent cytolysis, IgM lymphocyte binding, macrophage response to lymphokines, T helper-B cell adherence, and additional responses.[5] In animals, an induced magnesium deficiency impairs cell-mediated immunity and other responses. In humans, excess antibody production and susceptibility to allergies and chronic fungal and viral infections have also been associated with a lack of magnesium.

Epidemiological studies have linked higher intakes of magnesium with lower incidences of respiratory problems.[6] Magnesium has been used to treat and improve lung function in some individuals with asthma; however, these trials have involved intravenous magnesium and not oral magnesium supplements. [6] Further studies are needed to determine the value of magnesium supplements on asthma and respiratory-related ailments.

As people age, the requirements for magnesium increase, but the amount of magnesium in the body declines. The body is less able to absorb magnesium in the intestines, which further contributes to poor magnesium status. Older adults produce less hydrochloric acid in the stomach and the lack of stomach acid affects the body's ability to break down and absorb minerals like magnesium from the foods one consumes.

Furthermore, people who take prescription medications, such as diuretics, or those who have a chronic disease, such as heart failure or diabetes, can worsen already very low levels of magnesium.[7] Magnesium supplements, however, are not recommended for people with kidney failure or with atrioventricular blocks. Check with a doctor before taking magnesium supplements.

CMD or Concentrated Mineral Drops, MRI's all-natural, proprietary mineral and trace mineral complex is a rich source of magnesium. The suggested serving size or recommended dose provides over half of the daily value for magnesium. Besides its magnesium content, CMD also provides the

full spectrum of naturally occurring minerals and trace minerals, which act as tuning forks for full-spectrum mineral resonance in the body. Further, because CMD comes from a sea source (the Great Salt Lake in Utah), it is available in a form and balance that is more natural to the body.

Zinc (and Copper)

Zinc is an essential trace element. It plays structural, regulatory, and catalytic roles in the body.[8] It is necessary for a number of immune functions, including T-lymphocyte activity. A deficiency of zinc affects a number of aspects of innate and adaptive immunity and has been associated with decreased T- and B- lymphocyte function, depressed natural killer cell activity, depressed macrophage function, neutrophil function, and depressed antibody function among others.[8,9]

Like magnesium, zinc levels decrease with age, and even small deficiencies can have a big impact on immune health. One study reported "remarkable parallels" in immunological changes that occurred with zinc deficiency during aging including a reduction in the activity of the thymus and thymic hormones, a shift of the T helper cell balance toward T helper type 2 cells, decreased response to vaccination, and impaired functions of innate immune cells.[9] Supplementing with zinc may have the potential to improve immunity in the elderly.[9,10,11] In healthy individuals with marginal zinc deficiencies, zinc supplementation can enhance immune response.[8]

A review of ten randomized studies worldwide of zinc supplementation (dosage unavailable) in children reported a reduction of pneumonia of 41 percent and diarrhea in children by 25 percent.[8]

In healthy individuals, zinc supplementation may reduce the length of the common cold. One study reported that individuals who consumed a zinc lozenge (containing 13.3 mg of zinc) every two hours were sick on average 3.2 less days than people who did not take zinc. Another study reported that zinc supplementation reduced the duration of cold symptoms 42 percent compared with those who took a placebo.[8]

Mineral Resources International has formulated a concentrated liquid zinc formula called *Elemental Zinc with Copper*. This product can be added to water or other beverages and is designed to supplement the diet with significant levels of zinc. Each recommended dose provides 15 mg of zinc per ml and features a pre-measured dropper indicating .25 ml, .5 ml, .75 ml, and 1 ml measurements. MRI's recommendation is to add a lower dose of *Elemental Zinc* to water or whatever beverage one is consuming and consume multiple doses throughout the day. Consuming lower doses helps minimize the most commonly reported side effect of consuming too much zinc, which is nausea and mouth watering. It is also helpful because it coats the throat in zinc.

The Recommended Dietary Intake for zinc is 15 mg a day for men and 12 mg a day for women. Doses up to 30 mg a day are usually well tolerated.[8] The primary reaction to consuming too much zinc is nausea, mouth-watering, and, in some cases, vomiting. If this occurs, reduce the dosage of zinc to the recommended amounts for men and women.

Consuming too much zinc can deplete copper levels in the body. Therefore, *Elemental Zinc* is balanced with copper.

Trace Elements (Micronutrients)

Trace elements—boron, copper, chromium, iodine, iron, manganese, molybdenum, selenium, and zinc, to name a few elements—also known as micronutrients, are elements that are required in minute amounts for optimal growth, development and physiology.
Trace elements are indispensable for life and play an important role in essential functions, including immune function.[3] Low intakes of micronutrients have been shown to suppress immune function by affecting the innate T-cell mediate immune response and antibody response, which, in turn, increases the susceptibility to infections.[3] Further, infections—especially recurring infections—can further worsen existing micronutrient deficiencies by interfering with nutrient intake, increasing losses, and impeding utilization.[3] One study reported that adequate intakes of micronutrients including selenium, zinc, copper, iron plus vitamins B-6, folate, C and E mediated immune responses and increased risk of infections.[3]

A study conducted more than 24 years ago in children examined the levels of micronutrients in 28 children ranging in age from ten months to 10 years who were susceptible to infections (7 suffered from frequent upper respiratory infections, 16 middle-ear infections, 5 with lower respiratory tract infections), but who had not been diagnosed with an immune condition.[13] Thirteen healthy children aged 9 to 18 years were selected as controls and their serum micronutrient levels were tested as well. Researchers found that the children with frequent infections had significantly lower serum iron levels and zinc versus the healthy children.[13] The children with frequent ear infections, reported the authors, accounted for most of the differences in zinc and iron.[13] Serum levels of copper and magnesium did not differ significantly.[13] Researchers noted that an inverse correlation between the duration of breast feeding and serum concentration of zinc and between weight as well as height and serum magnesium.[13]

In 1997, a study involving 37 children with chronic tonsillitis evaluated the children's zinc, copper, and magnesium levels with the study's authors reporting that the mean serum level of zinc in the 37 children was significantly lower than the control group of 28 healthy children.[12]

Summary

Minerals and trace elements are vital for one's health and well being. Adequate amounts of minerals such as magnesium as well as micronutrients like selenium, zinc, copper, and others are required for optimal immune function, and individuals who may be deficient in these elements may be at risk. Unfortunately, most individuals do not receive adequate amounts of essential minerals and trace elements from the diet. Furthermore, as people age, the requirements for macro (magnesium) and micronutrients increase while certain factors such as the presence of a chronic disease or taking certain medications can further aggravate an existing mineral deficiency. Numerous compelling studies exist demonstrating that 1) low intakes of minerals and trace elements impair immunity,

resulting in increased illness and infection and a reduced quality of life and 2) that adequate intakes and status of certain minerals, trace elements, and vitamins support immune function and health.

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The Food and Drug Administration (FDA) has not evaluated these statements. This product is not intended to diagnose, treat, cure, or prevent any disease.

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