Basic Nutrient Support for Proper Immune Function

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An ever increasing number of patients are presenting to primary care practitioners with immune dysfunctions and various common infections. Of course, the challenge for a practitioner who is faced with such a patient is to intervene acutely while addressing the underlying cause of the illness to prevent a chronic pattern from developing. Proper nutrition is truly the best approach to preventing illness and supporting the immune system in order to protect the body maximally.

Indeed, foods can be "the best medicine," if the right foods are consumed. Ingesting the proper balance of macronutrients, proteins, fats, and carbohydrates is the first step toward more optimal immune functioning. The basic dietary rule is moderation and diversification: If your patients are eating whole foods, that have had a minimum of processing, from each of the basic food groups, these patients will have a head start when it comes to fortifying their bodies against immune challenges.

Marginal deficiencies are by far the most prevalent dietary problems seen in the United States. These problems can take the form of protein or caloric deficiencies. However, the largest problem is that most patients consume a relatively limited diet that is high in repetition and is all too often lacking in whole foods, such as fresh fruit, vegetables, and unrefined grains.

America's fascination with sugar also contributes largely to immunosuppression. The average person consumes 500 calories (125 g) directly from sucrose and an additional 200 calories (50 g) from other refined sugar sources. Research has documented that consumption of 100 g (less than the average daily intake) of sugar leads to reduced immune function. Within 30 minutes of consuming 100 g of carbohydrate, white-blood-cell activity become depressed; this lasts for approximately 5 hours. During the course of this carbohydrate-triggered immunosuppression, there is commonly a 50 percent decrease in white-blood-cell functioning.[1,2]

Even when patients consume relatively healthy diets, augmentation of such diets can prove to be helpful when patients are suffering from acute or chronic illnesses. Health-oriented patients often choose to engage in preventive supplementation. However, when it comes to immune modulating, nutrient selection should take into account whole-body health and not merely perceived needs. When the right nutrients are selected, not only can immune support be offered, but patients' other health conditions may also be addressed. Many nutrients frequently support multiple biochemical pathways and assist in correcting physiologic imbalances.

Carnitine

Carnitine is particularly indicated for patients who have weakened immune systems associated with fatigue, cardiovascular problems, or muscular weakness. Among the research materials that support the therapeutic use of carnitine are numerous reports indicating that patients with AIDS have reduced carnitine levels. Even when serum levels are not depleted, white-blood-cell levels are low.[3] Preliminary studies suggest that supplementation with 6 g of carnitine per day increased mononuclear cell proliferation, and decreased tumor necrosis factor.[4] Carnitine supplementation has also been shown to help overcome the deleterious effects that elevated cholesterol and triglycerides have on immune function.[5] There are many other nutrients that are specific to immune function and cancer. This article, however, is intended to provide general information about nutrients that are useful for healthful immune function.

Coenzyme Q10

Numerous studies have demonstrated the ability of coenzyme Q10 (CoQ10, ubiquinone) to enhance immune function.[6] CoQ10 provides critical energy for proper immune functioning, while conferring antioxidant protection. Elderly patients, in particular, can benefit from supplementation especially, because CoQ10 also plays a vital role in maintaining a healthy cardiovascular system.

Essential Fatty Acids

It has been estimated that at least 3 out of every 4 Americans consume inadequate amounts of essential fatty acids (EFAs). This dietary deficit manifests via a myriad of signs and symptoms, the most appreciable in the clinical setting frequently being dry skin, hair, and mucous membranes; aching joints; cracked nails; and constipation. Numerous other symptoms, including immune suppression, are often present, yet are more difficult to observe readily. Among immune condi-

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Summary of Commonly Prescribed Nutrients

Nutrient	Dosage
Carnitine	1500–6000 mg per day (divided doses between meals)
Coenzyme Q10	50–300 mg per day
Essential Fatty Acids	1–2 tbsp per day (high-lignan flaxseed oil)
Germanium	50–200+ mcg per day (doses vary greatly)
Lipoic Acid	50–450 mg per day (divided doses)
Molybdenum	200–600 µg per day (higher doses should be monitored)
Selenium	50–200 µg per day
Vitamin A/carotenoids	5,000-10,000 IU[a] per day (dosing beyond this range should be monitored)
Vitamin B_6	50–250 mg per day (patient may need to take with food to prevent nausea)
Vitamin C	1–10+ g per day (at high end of range, diarrhea can occur)
Vitamin E	400–1,600 IU per day (use cautiously in patients who tend to bleed)
Zinc	15–60 mg per day (should be taken with food to prevent nausea; use at high end of range for long period should be accompanied with use of copper)

[a]IU, international units.

tions that may be ameliorated by proper physiologic essential acid balancing are AIDS, autoimmune disorders, cancer, *Escherichia coli* infection, immune dysfunction, leukemia, and sepsis.

Fundamentally, EFAs are critical to health and optimal immunity because these acids are incorporated into healthy cells throughout the body. Cells comprised of EFAs are generally more functional and resistant to external insults. The immune-specific benefits of EFAs can be attributed to several factors, including the presence of lignans and the modulation of prostaglandins.

Flaxseeds have been found to have 100 times higher lignan levels than most other plant sources of this substance. Anticancer, antiviral, antibacterial, and antifungal properties have all been attributed to lignans.[7]

Germanium Sesquioxide

When used at proper dosages and purity, germanium supplementation can increase γ-interferon production that promotes natural-killer-cell (NK cell) activity and macrophage activation.[8] Traditionally, this nutrient has been reserved for cases of cancer, chronic fatigue, and severe immunodepression. Because toxicity has been reported in some cases, it is necessary to dispense germanium with caution.

Lipoic Acid

The highest levels of this nonvitamin are found in food sources, such as liver and yeast. Lipoic-acid deficiency has been linked to muscle wasting, brain atrophy, and increased lactic-acid accumulation. Lower serum levels of lipoic acid are also frequently found in patients with cirrhosis of the liver, diabetes, and heart disease. In a pilot study, supplementation with 150 mg of lipoic acid 3 times a day was shown to increase plasma ascorbate, glutathione, and T-helper cells and to optimize the ratio of T-helper cells to T-suppressor cells.[9] Other studies have demonstrated that lipoic acid also helps to inhibit HIV replication by decreasing the activity of reverse transcriptase.[10,11]

Molybdenum

Most research on molybdenum has been linked to deficiency states, and related disease conditions. In the United States, there has been a 30 percent increased risk of esophageal cancer, which has been documented in those parts of the country that have no or low molybdenum in the drinking water.[12] In China, soil low in molybdenum has also been linked to increased esophageal cancer.[13] Supplementation has been shown to inhibit chemically induced esophageal cancer in animal studies.[14] This nutrient has also been used therapeutically to decrease sulfite sensitivity, to prevent cavities, and to treat Wilson's disease.

Selenium

Selenium deficiency results in diminished resistance to infection. Supplementation with selenium stimulates leukocyte activity and thymus-gland function.[15] Even in the absence of deficiency, supplementation of 200 µg per day can bolster immune response. In a study conducted in 1994, individuals with normal serum selenium levels received selenium supplementation. In the subjects who received the supplementation, there was an 118 percent increase in ability of lymphocytes to kill tumor cells and an 82.3 percent increase in NK cell activity.[16] These

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immune-modulating effects have been attributed to selenium's ability to trigger interleukin-2 production.

Vitamin A/Carotenoids

The hundreds of carotenoids identified are routinely compared to beta-carotene relative to their provitamin A activity. This comparison, although accurate for vitamin A activity, does not reflect the other biologic properties of the carotene family. Many carotenoids show other biologic activities that are greater than beta-carotene, especially when it comes to antioxidant activity.

Individuals who are deficient in vitamin A and carotenoids often present with an overall increased susceptibility to infections resulting from decreased antibody production, diminished respiratory and gastrointestinal immunity, and a decreased total number of and activity of T-helper cells.

Carotenes have the ability to enhance immune functioning independently of their ability to be converted to vitamin A.[17] In a study of 126 healthy college students who were given either 25,000 international units (IU) of a placebo, in the form of a daily supplement, or the equivalent of 25,000 IU of beta-carotene from carrots. The study actually revealed that supplemental carotenes are absorbed better than those from carrots and other vegetables.[18,19]

Vitamin A deficiency has been associated with reduced B- and T-cell response to mitogens and antigens, impaired phagocytosis, and a decreased antibody response.[20,21,22]

Vitamin B_6

Pyridoxine (vitamin B_6) usually comes first to the clinician's mind as a treatment for neurologic conditions. However, vitamin B_6 deficiency has also been linked to decreased immune function. Individuals who are deficient in this vitamin may present with shrinkage of general lymph tissue and of the thymus, diminished thymic hormone activity, decreased total lymphocyte activity, and lowered antibody activity.[23,24] Clinically, patients treated with vitamin B_6 for a given neurologic problem, such as carpal tunnel syndrome, will report an enhanced sense of well-being and, often, a lowered tendency toward contracting illnesses.

Vitamin C

While fighting infections the immune system uses vitamin C and can actually become measurably deficient in the vitamin afterwards. Lymphocytes, in particular, normally contain high levels of vitamin C.[25] During periods of stress, urinary excretion of vitamin C increases; thus, the body's stores of the vitamin need to be replenished.[26] There a large number of epidemiologic studies that indicate that sufficient vitamin C reduces the risk of contracting colon, breast, lung, cervical, pancreatic, oral, and esophageal cancers.[27,28] It has also been demonstrated that vitamin C increases interferon levels, which has been linked, in part, to the vitamin's antiviral properties.[29]

Supplementation with 1–3 g per day can enhance immunity.[30,31] When a deficiency state exists in a patient, inhibition of neutrophil motility, diminished cellular immunity, and decreased phagocytic activity are noted.[20,32]

Vitamin E

The antioxidant properties of vitamin E provide protection to the thymus gland and to white blood cells. Sufficient levels of vitamin E become particularly important during chronic illness, such as prolonged viral infections, hepatitis, and AIDS. In one study, participants who had the lowest levels of vitamin E demonstrated a 50 percent increased chance of developing cancer, compared to subjects who had the highest levels of the vitamin.[33,34]

A patient who is deficient in vitamin E can present with a lowered immunoglobulin response to antigens, decreased lymphocytic response, and overall immune function.[23]

The Effects of Nutrient Deficiencies

Deficiencies of nutrients have been linked with some degree of immune impairments, as follows:

- Copper—increased potential for infections and leukopenia
- Essential fatty acids—decreased host resistance and poor wound healing
- Pantothenic acid—increased potential for infections
- Selenium—increased potential for infections
- Vitamin A—increased potential for infections
- Vitamin B_6—poor wound healing
- Vitamin E—decreased host resistance
- Zinc—increased potential for infections

Zinc

Zinc is by far one of the most critical minerals for overall immune functioning. Zinc's ability to optimize the immune system works directly and indirectly. Preventing zinc deficiency can help to ensure that the body manufactures adequate supplies of T cells and thymic hormones and maintains proper white-blood-cell functioning. The direct antiviral effects of this mineral have been attributed to the use of zinc lozenges, which are believed to provide sufficient zinc to prevent the replication of the viruses.[35] Zinc also plays an important role in helping to reverse the lowered

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immune functioning associated with aging. In a study of elderly subjects who were given zinc, each patient had elevated levels of thymulin.[36]

Conclusion

Although several nutrients have been highlighted in this article, proper total nutrition is by far the most critical factor in maintaining overall optimal immune function. When selecting a nutrient or group of nutrients to supplement patients' diets, clinical outcomes are most successful when each patient's unique nutritional status is addressed. For example, a patient presenting with small horizontal white lines on the finger nails, hyperkeratosis on the back of the arms, both of which are common deficiency signs, will benefit optimally when treated with the corresponding nutrients (in this case zinc, EFAs, and vitamin A) □

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