

# Nutritional Immunology: An Introduction

By Jessica Schulman, PhD, MPH, RD



**W**e have known for years that diet plays an important role in supporting a healthy immune system. Nearly a century ago, doctors wrote articles asserting that “consumption and pneumonia germs cannot establish themselves in a well-nourished body,” (1911, Washington Post). It has been more than 30 years since Dr. Jean Meyer, professor of nutrition at Harvard University, pointed out that “measles hardly ever kills a well-fed person,” (1974, Washington Post).

Today, nutritional immunology is a recognized field of study, and cutting edge researchers are working on understanding how nutrition status, infections and the immune system interact to affect health and disease. The main focus of this article is to offer some basic information about this emerging area of medicine.

For the immune system to function effectively, the body must have access to sufficient nutrients. If an individual is undernourished, simple skin tests, called delayed hypersensitivity tests, can point to immune dysfunction even in the absence of a true T-cell defect. Nutrients can be classified into micronutrients or “small” nutrients (i.e., vitamins and minerals) and macronutrients or “big” nutrients (i.e., fats, protein, carbohydrates). I will discuss each of these classes of nutrients in turn.

## **What Vitamins and Minerals Are Important?**

It is outside the scope of this article to provide specific dietary recommendations for each micronutrient, but there is a considerable amount of research that highlights the importance of adequate folic acid, vitamin A, vitamin B6, vitamin B12, vitamin C, vitamin E, copper, iron, selenium and zinc. Recently, scientists have reported that vitamin D has therapeutic potential in modulating immune-mediated diseases. People living with immune deficiencies and malabsorptive conditions are highly prone to micronutrient deficiencies. For such people, whole foods alone, even if carefully chosen, may still fail to provide adequate vitamins and minerals. In such cases, vitamin supplements may be warranted.

## **If a Little Is Good, Is a Lot Better?**

No! On the contrary, excessive intake of micronutrients can actually impair immune function. For example, one study showed that immune function improved when patients were given zinc supplements. Other studies, however, do not show any improvement and determined that high doses of zinc can be unsafe. Does this mean that the experts are being inconsistent? Not at all. The effects of zinc supplements are moderated by the level of zinc and protein already in the body. For individuals with a zinc deficiency, supplements may improve immune function, but for individuals with adequate zinc levels, supplements can have deleterious effects on the immune system. Supplemental zinc, for example, can block the absorption of iron – another mineral that affects general health and the immune system. Sometimes, excess amounts of one micronutrient can create a cascade of other problems. In a separate study, arginine (an amino acid) was shown to reduce infectious risk by stimulating the immune system. However, among people living with autoimmune conditions, immune-enhancing elements may actually intensify health problems.

## **How Do I Know If I Am Getting the Right Balance of Micronutrients?**

One way is to work with a qualified health professional such as a gastroenterologist and registered dietitian (RD). By studying the blood and taking a close look at dietary intake, they can determine what nutrients are lacking, adequate or in excess. If there is a deficiency, the next step is to determine why it is occurring. Finally, the physician can figure out how to safely remedy any deficiencies. Nutrition is very complex, but counseling by an experienced RD and contacting a professional association with a disease-specific support staff enable individuals to get proper dietary counseling that meets their unique needs.

## **Why Does Protein Matter?**

Protein contains essential amino acids that are the building blocks of life and regulate almost every

biochemical reaction in the body. Protein is therefore necessary for growth, healing and immune responses. For a healthy adult, about 0.8 grams of protein per kilogram (kg) per day is recommended. For example: a 150 lb. person / 2.2 lbs. (to convert lbs. to kg) = 68 kg person x 0.8 grams/kg = 55 grams of protein per day for a 150 lb. person. Infants and children need anywhere from 1 to 2 grams per kilogram of body weight per day depending on their age. However, illnesses change the equation substantially. During a serious infection or injury, most of the individual's initial weight loss comes from internal protein stores (e.g., muscle), so they may need two times the amount of protein – whether or not they are overweight.

Even before weight loss occurs, nutrition problems may show up as protein loss. Blood level of albumin is an easy measure of internal protein stores and level of nutrition risk. Some micronutrients, such as zinc, get to where they are needed in the body by taking a ride with the protein albumin. As a result, low albumin may cause a person to experience micronutrient deficits, which compromise immunity. Pre-albumin is a more timely and sensitive indicator of malnutrition. Always consult with a professional when estimating protein needs, because high protein diets are contraindicated in some medical conditions.

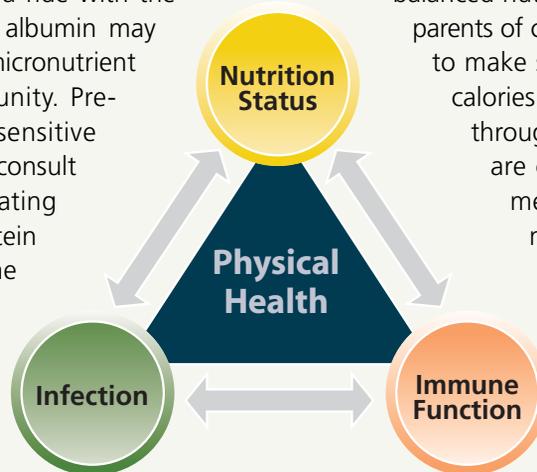
### Does Fat Affect the Immune System?

Because a high-fat diet decreases immune function, there may be benefits to a diet that includes low to moderate amounts of fat (20-35 percent of the diet). Yet recent evidence suggests that, in addition to the total amount of fat, health and immune function are greatly affected by the type of fats that people consume. For example, overemphasizing certain fats in the diet has been shown to alter the composition of immune cells. A high ratio of omega-6 (e.g., oils from corn, soybeans, safflower or cottonseed) to omega-3 fatty acids (e.g., fatty acids from salmon, herring, tuna, flaxseed, walnuts, canola oil or tofu) can contribute to inflammation. In contrast, marine animal oil or omega-3s (rich in docosahexaenoate [DHA] and eicosapentaenoate [EPA]) have been shown to influence lymphocyte proliferation and reduce some forms of inflammation. In some cases, this improves immune function, but the safety profile is unknown for many supplements and there are

still unanswered questions about the appropriate dosage. Until the benefits are better defined, it is advisable to work with a physician when any type of supplement is used. Current recommendations on dietary fats for the general public include a reduced intake of saturated fat and trans fatty acids, and balanced intake of poly- and monounsaturated fatty acids. Until more is known, a sensible approach includes a variety and balance of fats from different food sources.

### Does Body Weight Matter?

Maintaining a proper weight affects a person's ability to survive acute illness. Regardless of the presence or absence of infectious complications, sickness and death are more likely to occur when weight loss is uncontrolled. Because sick days make it particularly challenging to achieve a balanced diet, it is important to get proper and balanced nutrition whenever possible. For example, parents of children with immune deficiencies know to make sure that their children get enough calories when they are healthy to carry them through the periods when they are ill. These are children who cannot afford to skip meals, so kids who will eat only pizza may get to eat a lot of pizza.



### Are There Antibodies in Breast Milk?

Yes. Public health experts recommend that mothers nurse, pump and store milk as long as they are able and it is safe to do so. It

is now recognized that toddlers continue to benefit from breast milk because certain antibodies in the milk become more concentrated over time. Children with immune deficiencies and allergies are especially likely to benefit from extended nursing. In some cases, however, certain protein intolerances may preclude a mother from nursing her baby.

In sum, because nutrition status affects immune functioning in many ways, optimizing dietary intake may be one way to improve quality of life. Always consult with an experienced physician and nutrition expert for dietary recommendations that meet your individual health needs. ■

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