Immune health

The immune system is the body's primary defense mechanism against potentially harmful invaders, such as pathogens, antigens, and immunogens. The immune system is made up of various cells, tissues, and substances, including the skin, red and white blood cells, microbiota, antibodies, and cytokines (cell-signaling molecules).

The immune system's defenses are generally classified as two responses. The innate immune response, your first line of defense, is described as "non-specific" since the defensive actions do not differ between foreign substances. The adaptive immune response is the body's acquired or learned response to specific pathogens or other compounds that it has previously encountered.

Causes and risk factors for compromised immune health

Several factors may be associated with immune dysfunction and increased susceptibility to disease, including:

- Antibiotic use
- Certain health conditions (e.g., allergic asthma, certain cancers, depression, obesity)
- Certain nutrient deficiencies (e.g., vitamins A, B, C, D, and E, copper, iron, selenium, zinc)
- Chronic stress
- Excessive alcohol consumption
- Intense or excessive exercise
- Intestinal dysbiosis (i.e., imbalanced gut microbiota)
- Chronic sleep deprivation
- Sedentary lifestyle
- Smoking and e-cigarette use

Supporting immune health

The following lifestyle interventions may improve immune health and reduce disease risk.

Diet

Research suggests that a poor nutritional state impairs immune function and increases susceptibility to infectious and chronic diseases. Consuming a balanced, whole foods diet, such as the Mediterranean diet, supports overall health and immune function. The table below summarizes some immune-supportive dietary components and their dietary sources.

Component	Function	Dietary sources
Probiotics	May inhibit the growth of pathogens and reduce the risk of respiratory and gastrointestinal infections May help regulate the immune response	Cultured dairy (e.g., kefir, yogurt) Fermented soy products (e.g., miso, tempeh) Fermented vegetables (e.g., kimchi, sauerkraut, unpasteurized pickles)
Quercetin	May reduce the incidence and duration of upper respiratory tract infection symptoms May have anti-inflammatory properties	Apples Berries *Brassica* vegetables (e.g., broccoli) Onions Tea (e.g., black tea, green tea)
Vitamin C	Supports immune cell production and function Deficiency may increase the frequency and severity of infections such as pneumonia	Bell peppers Broccoli Brussels sprouts Citrus fruit (e.g., grapefruit, oranges) Strawberries
Vitamin D	Modulates the immune response Enhances the antimicrobial effect of certain immune cells Deficiency is associated with an increased risk of infections and autoimmune diseases	Beef liver Cod liver oil Eggs Fish (e.g., salmon, sardines, trout)
Zinc	Required to activate certain immune cells Deficiency is associated with impaired immune function and increased risk of infections such as pneumonia and infectious diarrhea	Animal proteins (e.g., beef, chicken, pork) Cashews Pumpkin seeds Seafood (e.g., oysters, crab, lobster) Yogurt

Physical activity

Research has shown that regular physical activity may have immunoprotective effects and may reduce the risk of certain cancers, such as breast cancer. On the other hand, strenuous exercise, such as competitive athletic training, may result in an impaired immune system and increase the risk of infections, such as upper respiratory infections. Current exercise guidelines for adults include a minimum of 150 minutes of moderate activity per week, such as brisk walking, biking, doing water aerobics, and playing tennis.

Sleep

Chronic sleep loss has been associated with immunodeficiency, increased inflammatory markers, an impaired response to influenza vaccination, and increased susceptibility to the common cold. According to the Centers for Disease Control and Prevention (CDC), adults require seven or more hours of sleep per night. Sleep hygiene practices, such as minimizing your exposure to blue light and maintaining a regular sleep schedule, may help you to improve sleep quality.

Stress management

Long-term or chronic stress may suppress immune function by decreasing immune cell count and increasing inflammatory responses. Incorporate ways to manage your stress, such as counseling, mindfulness, breathing exercises, and yoga.

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