

How Exercise Benefits the Immune System

Research shows 10 main ways in which exercise boosts the body's immune system to help it fight off illness.

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Many of the health benefits of exercise have been well studied and publicized. For instance, we know that different types of exercise can promote weight maintenance and muscle growth, improve respiratory endurance and cardiovascular health and increase bone density in weight-bearing joints. However, what many people don't know (or at least fail to understand) is that exercise also can improve the immune system.

Years of evidence support the claim that the right amount of certain types of physical activity can promote good health and improve symptoms in individuals with conditions of impaired immunity. Interestingly, the benefits of exercise appear to be similarly evident in persons with deficient immune systems and in persons whose systems are overly active (as is the case with autoimmune disorders). Although science still strives to better understand the exact relationship that links exercise and improved immunity, a number of theories have already been advanced.



Most people accept a few things on blind faith, but knowing how and/or why something works encourages many individuals to find a way to incorporate those things into their lives (assuming it is believed to be important). Exercise is no exception. Yet, to really understand the effects of exercise on the immune system, it's useful to first have a basic knowledge of the system itself.

The Immune System “Starting Lineup”

The immune system is an amazing and somewhat complex system, with the lymph vessels serving as its delivery (or highway) system. Lymph is a semi-clear liquid that carries needed water, oxygen and nutrients that have been transferred through the blood system (via the walls of the capillaries) to the cells themselves. Together, the lymph and lymph vessels transport uninvited guests and cell waste from the cells and their surroundings to the lymph nodes to be filtered, processed and drained. Lymph nodes are found throughout the body (including the sides of the neck) and frequently enlarge as they respond to new white blood cell production during an infection. For instance, when a person's glands are swollen, there's a good chance that his or her body is trying to fight something. Although any biologist would accuse us of oversimplifying the definitions, let's take a look at some of the major players of the immune system:

T Cells. Most of the cells that make up the immune system are white blood cells. One type of white blood cell, the lymphocytes, includes two major groups referred to as “T cells” and “B cells.” T cells have receptors on their surface that interact with molecules (i.e., small particles of a substance composed of two or more atoms) that are found on other cells of the body. By “hooking up” to the molecules, T cells can recognize the matter as something that is supposed to be in the body, or recognize it as a foreign substance or invader like a virus or bacterium. Once an invader is detected, the different types of T cells either work to directly destroy them or work to assist other immune cells in coordinating an attack.

Cytokines and Chemokines. One of the responses that T cells can mount against a trespasser is to secrete cytokines and chemokines. Cytokines are molecules that can activate other immune system cells that are nearby, or signal them to grow or to die. Chemokines are small groups of cytokines that attract more immune system cells to the area of the body where they are needed.

B Cells and Antibodies. Certain cytokines released by T cells will activate and direct another type of lymphocyte, the

B cells, to make specific antibodies (aka, immunoglobulin) against a foreign substance. Antibodies then seek the invaders and bind them to sites on their surface known as antigens. By binding to an antigen, an antibody can either neutralize the foreign object directly or mark it for destruction by other members of the immune system.

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Phagocytes. Phagocytes are white blood cells that are either stationary or circulate through the bloodstream and ingest harmful substances and dead or dying cells. A certain class of phagocytes, known as “professional” phagocytes (e.g., macrophages, neutrophils, monocytes, dendritic cells and mast cells), also possesses receptors on their surface (somewhat like those found on T cells). Once they have successfully engulfed a foreign invader, they will display part of its remains on their receptor and then present it to other cells of the immune system (including lymphocytes in the lymph nodes) to stimulate a larger response to the infectious agent.

Benefits of Exercise

Understanding how these players in the immune system work, let's look at 10 ways that exercise might benefit the immune system.

1. One of the most apparent benefits of light exercise is its ability to promote the flow of lymph and the immune



cells and antibodies it carries through the body. Unlike the arterial blood vessels, lymph vessels don't have the power of a pump (i.e., the heart) behind them. Instead, they depend on normal body motion, muscle contraction and manual manipulation such as massage to move the lymph along. Deep breathing with stretching (e.g., yoga or tai chi) is another effective exercise for circulating lymph.

2. Moderate exercise improves blood flow through the cardiovascular system, thereby helping to flush toxins and germs from the body through the excretory system via urine and sweat. Increased blood flow also keeps the antibodies and white blood cells needed to fight infection circulating rapidly as a possible early defense against foreign invaders.

3. When the body is deprived of sufficient oxygen as a result of high altitude, strenuous exercise, impaired breathing or other situations (a condition known as hypoxia), the immune function is impaired. Moderate exercise increases oxygen delivery through the bloodstream, thereby potentially improving the body's resistance.

4. Exercise slightly raises the body's temperature. Although the increase is not nearly as dramatic as running a fever (one of the body's natural reactions against many types of infection), it may still help to kill and/or inhibit the growth of an unwanted aggressor.

5. Scientific studies have recorded a temporary increase in phagocyte activity and function immediately following

exercise. It is believed that this increase could take some potentially harmful substances out of the bloodstream before they ever get the chance to travel further. It may also help to boost the fight against an active infection.

6. Regular exercise may help the lungs to rid themselves of airborne viruses and bacteria that are associated with respiratory tract infections.

7. A certain group of cytokines are produced as a consequence of muscle contraction during exercise. One of these cytokines, IL-6, initially promotes inflammation (an important first response of the immune system against infection), but is shortly followed by an increase in anti-inflammatory cytokines. Turning off the inflammation phase is just as important as turning it on; otherwise, tissue and organ damage can occur.

8. T1 helper cells also stimulate inflammation and other changes in the body as a first defense against infection. They are followed by T2 helper cells that produce an anti-inflammatory response. A recent study at the University of Illinois demonstrated that moderate exercise in mice appears to accelerate the change from a T1 to T2 response enough to help combat infection with the flu.

9. Another recent study conducted at Iowa State University found that mice that regularly ran on a treadmill during a period of three and a half months experienced flu symptoms that were less severe than those developed by mice that did not exercise. The study's lead researcher suggested that repeated stress from moderate exercise may improve the body's ability to respond to other types of stress, like those caused by the flu.

Even relatively low levels of aerobic exercise can help to boost the immune system.

10. Speaking of stress, one of the greatest benefits of regular exercise is its ability to help relieve mental and emotional stress linked to suppressed immunity and increased illness. Exercise helps to provide an outlet for nervous energy, take our mind off of our greatest concerns (at least momentarily) and improve our body image. It also

reduces the emission of stress-related hormones long thought to suppress the immune system.

Putting Science Into Action

The 1st century Roman philosopher Marcus Cicero declared, “Never go to excess, but let moderation be your guide.” These words should be applied prudently toward many aspects of our lives: eating, drinking, sleeping, working, playing — and exercising! Note that the key to the positive outcomes observed in many of the theories and research listed above is “regular and moderate exercise.” In fact, many studies assert that high-intensity or strenuous exercise can actually cause a temporary decrease in the immune system’s defenses, referred to as an “open window” period, which can last anywhere from three to 72 hours following the activity. Arduous exercise may also exacerbate other symptoms with autoimmune diseases. Of course, exercising too little or not at all can be just as detrimental to an individual’s health.

So, how much exercise is just the right amount? The answer, of course, varies somewhat among individuals, and a doctor should always be consulted first before beginning a new program or before making any major changes to a routine exercise program. However, even relatively low levels of aerobic exercise can help to boost the immune system. Generally speaking, 20 to 30 minutes of a low-impact activity (e.g., brisk walking, light jogging, swimming or biking), three to five times a week, is a great place to start. Regular moderate exercise appears to have a cumulative effect that leads to a more permanently improved immune response, and again, the benefits seem to be accessible to nearly everyone, regardless of their personal immune status or history.

Several other factors can contribute considerably to the effects of exercise on the immune system and should be considered when planning activities. For example:

- Exercise is discouraged in extreme heat or cold because the changes that are required to help regulate the body’s temperature can be stressful to the immune response. Those who live in a cool climate during the winter months should plan more indoor activities like swimming, stationary biking, or walking or jogging on a treadmill (good sanitation techniques should be used when using public facilities). Those who live in a hot climate should try to arrange outdoor physical activities earlier in the morning or later in the evening to escape the heat of the day.

- Exercising at especially high altitudes or in areas of high air pollution should be avoided, because both situations

can stress the respiratory system and, in turn, the immune system due to decreased oxygen in the air.

- Finally, individuals who aren’t feeling well need to be honest with themselves. When ill, the immune system is already under strain from trying to fight the infection. The related stress caused by exercise may challenge recovery. However, for individuals who feel like they are just coming down with something, symptoms are mild and they don’t have a fever, there is evidence to suggest that moderate exercise might actually decrease the duration and severity of a mild infection (a doctor should always be consulted for direction).



Remember that there are many benefits of exercise besides those immediately related to an improved immune system. If 20 to 30 minutes of walking is beyond an individual’s current ability, there is always something that can be done (see the article, “Exercise and Immune Disease” in the December-January 2010 issue of *IG Living* magazine). The body’s little friends are working hard to maintain well-being — and sending them a big breath of fresh oxygen can only help. ■

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