

# SMOOTHIES

for better  
health



**100**

NUTRIENT-PACKED DRINKS  
TO BOOST YOUR ENERGY  
AND SUPERCHARGE  
YOUR IMMUNE SYSTEM

**ELLEN BROWN** FOUNDING FOOD EDITOR OF *USA TODAY*  
WITH KAREN KONOPELSKI HENSLEY, M.S., R.D.





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This book is dedicated to  
Ilan, Mira, and Lev Dubler-Furman,  
the small folk who bring such large joy to my life.



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# PREFACE

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There has been something of a nutritional awakening in the past decade, and we now fully appreciate the direct correlation between our diet and overall health. We now know what foods are bad for our health and can lead to problems ranging from heart disease to cancer, and we also know what foods promote good health by delivering key nutrients that the body cannot make and therefore must obtain from either foods or pills containing nutritional supplements.

Cutting back on the so-called “bad fats”—first saturated fat and then trans fat—while increasing the variety and amounts of fruits, vegetables, and whole grains we eat daily has become part of our way of life. These foods now form the base of the nutritional pyramid that has replaced the former food groups chart.

For many people, however, a dichotomy exists between the centerpieces of our meals and what we eat for snacks or dessert. These treats may not be filled with empty calories from refined sugar or processed grains, but neither are they contributing to our health and well-being—and they should be.

Smoothies fill the niche when you want a food that tastes decadent during the day or at the end of a meal, but you also want it to be good for you. Smoothies are the healthful grandchildren of the malteds and milkshakes of my youth, and they can be created from a cornucopia of nutritious fruits and other beneficial ingredients. For breakfast they are the perfect “car cuisine” because they can be sipped while driving. They are a flavorful treat for children and adults at any time of day, and they make wonderful desserts, too.

The smoothies in *Smoothies for Better Health* accomplish much more than quenching your thirst with thick and frosty drinks. I chose specific ingredients that contain the nutrients you need to keep your all-important immune system in optimal condition. The immune system has a vital role in protecting your body from disease and fighting infection if it does invade.

It is an interesting paradox that as modern medicine has eradicated many of the diseases that were potentially fatal in past eras, the current levels of environmental pollutants threaten our immune systems on a daily basis. Rather than the immune system having less work these days, it is tested every time we breathe.

Each of these one hundred recipes is annotated both for its overall nutritional content and for the specific nutrients it delivers that fortify the immune system. But we don't sip numbers; we sip smoothies. And these recipes are designed to tempt your taste buds and give you the satisfaction of a decadent treat.



## CHAPTER 1

# THE FOOD PHARMACY: HOW NUTRIENTS KEEP YOU HEALTHY

Adages such as “An apple a day keeps the doctor away” and “You are what you eat” are true: There is a direct correlation between a diet rich in nutrients and low in fat and our ability to remain healthy. A crucial component of good health is a strong immune system that guards against penetration by harmful micro-organisms and fights them if they manage to infect the body.

We are now able to identify which nutrients boost our immune system, making it possible to prime that valuable pump and keep it in top form. This chapter is a crash course of the immune system that will introduce you to its multiple facets. You’ll also learn which nutrients are vital for keeping this defense system as robust as possible.

## HOW YOUR IMMUNE SYSTEM PROTECTS YOU FROM HARM

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The immune system is a collection of complementary defense mechanisms that protects against infection by identifying and killing pathogens—any outside invader that triggers an immune response—that can range from viruses and bacteria to parasites and fungi. It is not easy for the immune system to detect these pathogens: They want to survive so they have a way of adapting to the host organism—in this case your body—in an effort to remain undetected. The immune system must therefore act like a well-trained commando; it is trained to look beneath the camouflage, find the pathogen, and then destroy it.

Every living organism—including those with a single cell—is armed with this type of defense mechanism. However, in highly developed species like humans, this mechanism has evolved into a complex system made up of many types of proteins, cells, organs, and tissues that interact as a dynamic network.

The immune system protects you from infection with layered defenses of increasing specificity. First there are physical barriers—termed nonspecific defenses—that prevent pathogens from entering the body. The most obvious physical barrier is your tough outer covering of skin and mem-

branes. As long as the skin remains free of injuries ranging from scrapes and burns to irritation from chemicals, it can hold the body's insides in and safely keep the rest of the world out.

Other barriers protect the internal parts of your body that are open to pathogens. Enzymes in the mouth's saliva and nose hairs, for example, are part of the immune system, and involuntary acts such as coughing and sneezing eject pathogens from your respiratory tract.

In your stomach, gastric acid serves as a chemical defense against pathogens. Other bodily fluids also form part of this first line of defense. Tears flush out your eyes, and urine expels pathogens from the urinary tract.

If pathogens or toxins make it past the nonspecific defenses, specific defenses (described later in this chapter) are activated. For the immune system to work properly, two things must happen: Your body must recognize that it has been invaded, and the immune response must be activated quickly before the pathogens gain a strong hold.

## The Organs That Keep You Healthy

As we now know, the immune system is a complex and dynamic network that battles to keep infection out of our bodies and fight it if it penetrates. While all components of the immune system work harmoniously to battle diseases, some are more vital than others. For example, we can live without our tonsils and spleen but not without our skin or bone marrow.

The organs involved with the immune system are called lymphoid organs and their functioning—along with that of the lymphatic vessels—makes up the lymphatic system. The lymphoid organs work together to produce infection-fighting white blood cells called lymphocytes, which are released into the bloodstream and play a vital role in keeping us healthy.

The lymphatic system has three related functions: It removes excess fluids from body tissues, it absorbs fatty acids, and it transports these needed fatty acids to the circulatory system. The system is comprised of the following:

- **Lymph nodes.** Small organs (they range in size from a few millimeters to a centimeter) shaped like kidney beans with a honeycomb structure, lymph nodes are located throughout the body and connect with one another via the lymphatic vessels. They are sometimes incorrectly called lymph glands; however, they are not glands because they do not secrete substances. The five hundred to six hundred nodes in our bodies have clusters in the underarms, groin, neck, chest, and abdomen. These nodes are components of the lymphatic system, and they contain white blood cells and filter foreign particles. These nodes swell when the body is fighting an infection due to their accumulation of lymphocytes and fluid.
- **Lymphatic vessels.** A network of channels that carry the lymphocytes to the organs and into the bloodstream, the lymphatic system, in contrast to the blood system, is not closed and has no central pump

such as your heart. Its movement is slow and has low pressure due to peristalsis—smooth muscle contractions of the intestinal tract—and the slow squeezing (called a “milking action”) of skeletal muscles. Like veins, however, lymphocytes travel through vessels in one direction only.

- **The spleen.** An organ about the size of a small fist, it is located in the upper left part of the abdominal cavity behind the stomach and just below the diaphragm. It is held in place by ligaments to other organs such as the stomach and kidney. The spleen acts like a filter. It destroys old red blood cells and filters the blood that captures foreign materials.
- **The thymus.** An organ comprised of two lobes that are joined by strands of connective tissue, it is located above the heart and below the thyroid gland. Each lobe is organized into two compartments: The cortex is the outer compartment and the medulla is the inner compartment. Lymphocytes divide in the cortex, and, as the T-cells mature, they migrate into the medulla and eventually into the bloodstream. Although the thymus gland becomes vestigial by the onset of puberty, it plays a critical role in the development of a child’s immune system both before birth and during the first two years of life.
- **Adenoids.** Two glands located at the back of the nasal passage, where the nose blends into the mouth, their function—like that of all lymphoid tissue—is to trap infectious agents and produce antibodies. Due to their position, they most often defend against pathogens that are inhaled into the body.
- **The tonsils.** Two ovals at the back of the throat, their position allows them to defend against upper respiratory tract infections. Both adenoids and tonsils are frequently removed, especially in children, due to their propensity for infection. In the event they are surgically removed, other components of the immune system work harder to fill the gap.
- **The blood vessels,** which include arteries and veins through which blood flows. If laid end to end, the blood vessels in an average human body would stretch more than sixty thousand miles.
- **Bone marrow.** The spongy tissue found inside the cavities of our bones, bone marrow initially produces all blood cells—white blood cells (leukocytes), red blood cells (erythrocytes), and platelets (thrombocytes)—through a process called hematopoiesis. There are two types of bone marrow, red and yellow, and the lighter color is due to a much higher number of fat cells. The red marrow is found mainly in flat bones, like the hips and shoulder blades, and the yellow marrow is found in the hollow interior of the middle portion of long bones.

## Why Cells Are Your Soldiers

All blood cells, including lymphocytes, are produced from stem cells within the bone marrow. If they continue to mature in the bone marrow, they become B-cells, while other lymphocytes complete maturation in the thy-

mus and become T-cells. These two groups of cells recognize when infectious micro-organisms have infiltrated the body and begin to attack them.

The first step is that these cells sense the presence of an antigen (a foreign substance that invades the body), which stimulates an immune response. The word antigen was coined because it stimulates *antibody generation*. Some antigens enter the body from the outside; we may inhale them or ingest them in food. These antigens frequently trigger allergic reactions. Other antigens are generated within the cells as a result of normal cell metabolism or because of viral or bacterial infection.

B-cells give rise to cells that produce proteins called antibodies and secrete them into the body's fluids. Antibodies can bind to the antigen and interfere with its ability to function. Alternatively, they can stimulate an inflammatory response that attracts neutrophils, monocytes, and macrophages (types of white blood cells) to the site of infection and kills the bacteria in one of two ways: by penetrating the cell's membrane or by activating a complementary antigen that targets the first antigen for attack as it would a healthy cell (the two antigens basically neutralize each other). B-cells are free to circulate in the bloodstream, but they cannot penetrate living tissue.

T-cells work in a different way. The major difference is that they are created as immature cells and are sent to the thymus to be programmed to recognize one specific target antigen. A T-cell can move anywhere in the body, and it can destroy cells that it has been programmed to attack by attaching itself to the targeted cell and injecting it with strong chemicals.

T-cells are divided into two groups. "Killer T-cells" destroy cells that have been infected with viruses and other pathogens or are otherwise damaged; this type of cell is very important in blocking the replication of viruses. "Helper T-cells" regulate the immune responses by communicating with other cells, and they help determine what type of immune response the body will make to a specific pathogen (think of them as traffic cops). T-cells can assist B-cells by triggering a chain reaction that causes the B-cell to form plasma cells. These plasma cells then begin to produce more B-cells, thus allowing the number of antibodies to increase exponentially. Other T-cells then have the job of monitoring the level of antigens present in the body, and they will stop the production of B-cells when the infection has been eliminated.

While these are the two main types of cells, there are others. Granulocytes or polymorphonuclear (PMN) leukocytes are another group of white blood cells whose primary importance is removing bacteria and parasites from the body. They engulf these foreign bodies and degrade them using powerful enzymes.

Macrophages are scavenger cells that help initiate and regulate the immune response. They pick up and ingest antigens and present these foreign materials to the B-cells and T-cells for destruction.

Another cell type, dendritic cells, originates in the bone marrow and functions in a similar way. They are usually found in the lymphoid organs,

although they can be in the bloodstream or other tissues of the body. Dendritic cells capture antigens and bring them to one of the lymphoid organs to trigger an immune response.

## HOW WE RID OURSELVES OF INVADERS

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Now that you know all the players, here is a summary of how the game is played, or, in this case, how an immune response works. The membrane of virtually every cell is studded with various proteins, which together are known as the major histocompatibility complex, or MHC. The MHC molecules function as transporters, carrying fragments of proteins from within the cell to the cell surface, where they are presented to the immune system. T-cells only recognize an antigen if it is carried on the surface of a cell by one of the body's own MHC molecules.

The scouts then begin. The first action is that a macrophage or dendritic cell—called the antigen-presenting cell, or APC—begins working in combination with either a B-cell or a T-cell. If the APC presents an antigen on its surface to a B-cell, the B-cell is signaled to proliferate and produce antibodies that specifically bind to the antigen. These antibodies then destroy the antigen. If the APC presents the antigen to a T-cell, the T-cell is activated to kill the antigen.

### Battling Free Radicals with Antioxidants

The role of oxygen in our lives is a mixed blessing: It's essential to maintain life, yet it simultaneously harms our cells. To put it in the simplest terms, an antioxidant is a substance in the diet that reduces cellular damage that has been caused by oxygen.

When molecules anywhere in the body are afflicted by oxygen, they are called free radicals. Unfortunately, we don't have a magic bullet to prevent molecules from becoming free radicals because it is a natural part of the metabolic process. Moreover, environmental pollution has increased the number of free radicals in our bodies, and we therefore have a greater need for antioxidants.

The cell damage caused by free radicals can lead to anything from heart disease to cancer, so mitigating their effects with antioxidants is crucial to your health. Even skin creams are now formulated with antioxidant nutrients to counteract the effects of ultraviolet light, one of the environmental causes of cell damage.

We now know that maintaining a diet rich in antioxidants—found in fresh fruits and vegetables—is a way to boost the immune system. Many of the protective functions of the immune cells depend on the fluidity of the membranes of the cell. Free radicals reduce this fluidity and keep the cells of the immune system from their appointed tasks.

A bit of chemistry is necessary to understand how antioxidants and free radicals interact. The human body is composed of many different

types of cells, and cells are composed of many different types of molecules. Molecules consist of one or more atoms of one or more elements joined by chemical bonds.

As you probably remember from science class, atoms consist of a nucleus, neutrons, protons, and electrons. The protons—positively charged particles—are located in the atom’s nucleus while the electrons—negatively charged particles—surround the atom. Electrons orbit an atom in one or more shells, and the most important structural feature in determining the chemical behavior of an atom is the number of electrons in its outer shells. A substance with a full outer shell is inert, but an atom will try to fill its outer shell by gaining or losing electrons or by sharing its electrons by bonding together with other atoms.

Normally, bonds do not split in a way that leaves a molecule with an odd, unpaired electron. But when weak bonds split, free radicals are formed. These free radicals begin to attack the nearest stable molecule to capture the electron needed to gain stability. This triggers a chain reaction: When the “attacked” molecule loses its electron, it, too, becomes a free radical. Antioxidants are known as “free radical scavengers”—they neutralize free radicals by donating one of their own electrons, thus ending the electron “stealing” action.

Antioxidant nutrients do not become free radicals themselves when they donate electrons because they are stable in either form. So they roam the body and act like a good housekeeper, mopping up free radicals before they can inflict damage on cells and tissue. For example, the cholesterol in your body is not harmful until it becomes oxidized, at which point it begins to cling to your blood vessels and clog your arteries, possibly leading to heart disease and stroke.

Many antioxidants work best when combined because they contain complementary nutrients; in this case, the whole is greater than the sum of its parts. And drinking smoothies offers you a significant advantage because they typically contain complementary antioxidants.

## HOW TO USE FUNCTIONAL FOODS FOR HEALTH

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Your immune system is the body’s first line of defense against bacteria, viruses, and other foreign invaders. However, the immune system can only fight infection if it is constantly supplied with the necessary “weapons.” Foods are the crucial supply lines that support the troops.

With rare exception—such as our ability to generate vitamin D when exposed to sunlight—eating foods that are high in specific immune-boosting nutrients is the best way for our bodies to gain access to these key disease

fighters. The body needs protein, fatty acids, vitamins, and minerals on a daily basis. Ideally these nutrients should come from the foods we eat; the alternative is to take vitamin and mineral supplements.

Vitamins are either water soluble or fat soluble, and those that are water soluble cannot be stored in the body for more than a brief amount of time before they are removed by the kidneys and excreted in the urine. The entire group of B vitamins, including the immune-boosting B6 and antioxidant-loaded vitamin C, fall into this group.

Fat-soluble vitamins are absorbed using bile acids (the fluids used to digest fats). Once they are absorbed, your body stores them in the liver and body fat and removes them when necessary. The fat-soluble vitamins that matter most to the immune system are vitamin A and vitamin E.

While it is possible to identify the exact levels of vitamins in the foods we eat, the mineral content will vary depending on a number of factors. This is because minerals come from the earth or from water, and plants and animals absorb them to get nutrients. The mineral content of the food is therefore dependent on: the mineral content of the soil in which the food was grown; the minerals present in the water used for irrigation or nourishment by the animal food source; and the mineral content of the foods eaten by the animal food source. Magnesium, manganese, selenium, copper, iron, and zinc are the minerals most closely linked to a strong immune system.

It is preferable to obtain vitamins and minerals from food rather than from a pill because nutrients must be taken in tandem for the body to achieve optimal benefits and supplement pills do not contain the same phytonutrients as foods. For example, iron absorption is increased when it is taken with vitamin C, and vitamin D aids in the absorption of calcium (the reason most milk is fortified with vitamin D).

In the past decade the international nutritional community has begun to advocate a diet that goes beyond simply maintaining a healthy immune system to one that actively aids in the prevention of disease and enables the immune system to fight disease if it occurs. A study published by the *European Journal of Clinical Nutrition* refers to this diet as “functional food,” which is the term used by countries in the European Union; in the United States the term “nutraceutical” is frequently used.

Functional foods are conventional foods eaten as part of a normal diet that contain large amounts of immunity-boosting nutrients. All of the smoothie recipes in this book were formulated with ingredients that qualify as functional foods. The advantage of eating them as part of a smoothie is that you accomplish the primary goal of combining foods with complementary nutrients—easily and deliciously.

## HOW NUTRIENTS BOOST YOUR IMMUNE SYSTEM

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Every five years, the U.S. Department of Health and Human Services joins forces with the U.S. Department of Agriculture to advise Americans on ways to promote health and prevent disease. In 2005, the date of the most recent report, they found that many Americans consume more calories than they need without meeting the recommended intakes for a number of key nutrients. These nutrients include:

- For adults: calcium, potassium, fiber, magnesium, and vitamins A, C, and E.
- For children and adolescents: calcium, potassium, fiber, magnesium, and vitamin E.

An additional premise of the federal dietary guidelines is that these nutrients should come primarily from foods that are termed “nutrient dense,” meaning foods that provide substantial amounts of vitamins and minerals and relatively few calories. The reason it is important to gain these nutrients from foods rather than supplements is that foods also contain hundreds of naturally occurring substances, including carotenoids and flavonoids, that may protect against chronic health conditions. You will find all of the listed nutrients in the fruits, nuts, and other ingredients used in this book’s smoothie recipes, in addition to protein and carbohydrates, which the body also needs to function properly.

### Super-Star Nutrients

Certain nutrients play a more pivotal role in boosting the immune system than others. Here are the most important nutrients for keeping your immune system in tip-top shape and for boosting it when necessary to fight illness:

- **Carotenoids**—Beta-carotene, which gives foods like carrots, sweet potatoes, peaches, and papayas their orange color, may be the member of this group you read the most about, but there are many others in this widespread category of naturally occurring pigments. All carotenoids provide what is termed provitamin A, which the body converts to retinol, the active form of vitamin A. Lycopene, which gives tomatoes their red color, is a carotenoid that has been widely discussed by the news media for its role in preventing heart disease. (Because lycopene operates slightly differently from the majority of the pigment-producing compounds, it is discussed separately later.) Carotenoids are powerful antioxidants and therefore enhance the functioning of the immune system. Luckily, there is a veritable rainbow of fruits that are high in these valuable nutrients.
- **Copper**—Two delicious smoothie ingredients, sesame seeds and sunflower seeds, are particularly high in this mineral. Copper is an essential component of many enzymes, so it plays a role in many

physiological processes. Most of the copper content in your bloodstream is incorporated into a compound called ceruloplasmin, an enzyme that facilitates the oxidation of minerals, including iron.

- **Cysteine**—Many smoothie recipes include yogurt—in part because of its cysteine content. Cysteine is an amino acid that protects cells from free radical damage. It also breaks down proteins found in mucus that settles in the lungs, making it very helpful to the respiratory system.
- **Flavonoids**—This term encompasses more than six thousand different substances that are found in plants and are responsible for their color. Most flavonoids function in your body as antioxidants and regulate inflammation—your body’s natural response to danger—so that the immune system is not overly stimulated. The final benefit of flavonoids to your immune system is that they can act as an antibiotic by disrupting the progress of certain viruses or bacteria (this antiviral action has proven effective with the herpes simplex virus, for example).
- **Folate**—Your immune system’s first line of defense is the skin, and that’s where folate becomes important. Folate is a B-complex vitamin most recognized for its importance during pregnancy in preventing birth defects, but its significance is far more wide ranging. Folate helps to produce and maintain new skin cells, and it is needed to make DNA and RNA, the building blocks of cells.
- **Glutamine**—Your body synthesizes this amino acid from another amino acid called glutamic acid or glutamate. In addition to supporting the health of your intestinal tract, glutamine helps to maintain the body’s acid-base balance. Glutamine is pertinent to your immune system because it serves as a precursor (a chemical that is transformed into another compound) to the antioxidant glutathione.
- **Iron**—Sustaining a proper level of this mineral is crucial because iron serves as the core of the hemoglobin molecule, which is the oxygen-carrying component of red blood cells. Its role in the immune system is a general one, but a good supply of dietary iron helps optimize blood iron levels.
- **Lipoic acid**—This nutrient is vital to your body because it helps turn glucose (blood sugar) into energy for the body’s needs. Lipoic acid is the only antioxidant that can deactivate free radicals in both water-based and fat-based environments. As an antioxidant, lipoic acid prevents oxygen-based damage to nerves, and it has also been shown to strengthen the effects of other antioxidants such as vitamins C and E.
- **Lycopene**—A member of the carotenoid family of phytonutrients, lycopene is most often associated with the red color of tomatoes, although it is found in foods as diverse as watermelon and peanuts. Unlike several of its carotenoid cousins, lycopene does not get con-