

Maximize the Power of Omega-3s to  
Supercharge Your Health, Battle Inflammation,  
and Keep Your Mind Sharp



the  
Ultimate  
Omega-3  
Diet



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# Omega-3 and Omega-6 Fats

**U**NLESS YOU LIVE in an isolated bubble, you have likely seen the bounty of headline-grabbing studies on omega-3 fats, with their far-reaching benefits from preventing cancer and heart attacks to treating depression and arthritis. Indeed, short of describing these fats as a panacea, the research is quite astounding.

How can one type of fat affect so many different parts of your body (such as your brain and heart) and ultimately influence your health and well-being? There are two key reasons. First, omega-3 fats are really like vitamins (originally called vitamin F when discovered). Unfortunately, the vast majority of Americans are deficient in vitamin F or omega-3 fats.

Second, although few people know it, we have a striking fat imbalance in our diet. The typical American diet dramatically antagonizes the benefits of omega-3 fats in the body. *Even if you consider yourself health-conscious, you are not likely free of this problem!* The problem of this dietary fat imbalance affects you whether you eat heart-healthy, are a strict vegetarian, have become an Atkins carnivore, or something in between. We eat too much of the so-called heart-healthy fats, which, ironically, interfere with the benefits of omega-3 fats in our bodies. These supposedly healthful fats are the

omega-6 fats, which have flooded our food supply in the forms of margarine, soybean oil, corn oil, safflower oil, cottonseed oil, and sunflower oil.

In short, we have two key problems. We don't eat enough (and the right kinds) of omega-3 fats; call this problem *omega-3 fat deficiency*. And we eat too much of the so-called healthy fats that hamper omega-3 fat's benefits, causing what some researchers call *omega-6 fat syndrome*. Let's take a closer look.

## Omega-3 Fat Is a Vitamin

In the 1920s, one of the several omega-3 fats was discovered. The researchers determined that it is essential for health and met the scientific criteria to be called a vitamin. Appropriately, this fat was named "vitamin F." Yet you probably haven't heard of vitamin F.

Why not? You can rule out omega-3's fatty nature as the reason it lacks "vitamin status," because there are other fat-based vitamins: vitamins A, D, E, and K. Instead, chalk it up to a bit of politics and bad timing. At the time of the vitamin F discovery, vitamin E also had just been discovered. Because of the scientific excitement over the newly discovered vitamin E, vitamin F was ignored and disappeared into oblivion (until the last decade). Although research on omega-3 fats has exploded, the name *vitamin F* never resurfaced.

It's too bad that the *vitamin F* nomenclature didn't stick. That term alone would emphasize how essential these fats are to our body. As with vitamins, our body can't make these fats (or enough of them), so they are required in our diet. Also, a step up to "vitamin status" could have spurred earlier research on the vital roles that omega-3 fats play in human health and disease prevention.

After the discovery of omega-3 fats, 50 years passed until the first human case of omega-3 fat deficiency was identified. A child too sick to eat was fed intravenously with a mixture that contained no omega-3 fats. Instead of getting better, the child got unexpectedly worse and displayed symptoms of numbness, tingling, weakness, inability to walk, leg pain, psychological disturbances, and blurred vision. Ralph

T. Holman, an expert in omega-3 fats, identified the cause of the child's problem as a deficiency of omega-3 fatty acids. His discovery put omega-3 fats on the map, beyond an esoteric research interest.

The incredible research into omega-3 fats *within the context of their role as an essential vitamin* helps to explain omega-3's sweeping effects on health and disease. A new picture emerges of a nutrient deficiency that wreaks havoc in many different parts of the body, from the inner workings of the brain to the battlegrounds of immunity and inflammation. A vast majority of Americans do not get enough omega-3 fats in their diet.

### Different Omega-3 Fats Affect Your Body in Different Ways

Just as there is more than one type of B vitamin (vitamins B<sub>1</sub>, B<sub>2</sub>, B<sub>12</sub>, and so forth), there is more than one type of omega-3 fatty acid. Each of these omega-3 fatty acids affects your body in different ways. The types of omega-3 fatty acids found in plant foods are very different from those found in fish. So if you are tanking up on plant sources of omega-3 fat, such as flax meal or flaxseed oil, you still could be deficient in the other omega-3 fats that are found primarily in fish. For example, many of the foods that boast of their omega-3 fat content are fortified with the plant form of omega-3 fat, not the types found in fish. This is not necessarily bad, but some consumers might be under the wrong impression that they are getting enough omega-3 fats when they are actually still deficient in certain types.

### Structural Sentries

Omega-3 fats are involved in nearly every key function in the body and are an important structural part of *every* cell in your body. They are not the kind of fat that sits around for a rainy-day famine, waiting to be utilized. Let's look briefly at some of these vital roles:

- **Biological fence.** Omega-3 fats are the gatekeepers of cells. They make up the key architecture of the membrane, the biological fence that surrounds each cell. This affects the fluidity of the cells, which in turn influences a number of activities in your body.

Notably, the composition and fluidity of cell membranes depend to a great extent on what you eat.

- **Brain's building blocks.** Omega-3 fats are the key building blocks of the brain and eyes. They are to your brain as calcium is to your bones. In fact, the majority of the brain (60 percent) is composed of fat—the second highest concentration of fat in the body.

### **Essential Activities**

Omega-3 fats are industrious worker bees throughout your body. Here's a glimpse at their far-reaching impact on your health:

- **Cellular communication.** The cells in your body use wireless communication, and omega-3 fats help them stay in touch. It's a lot like cell phone reception. If you don't have enough omega-3 fats, your cell-to-cell communication can be "out of range." This is especially significant to brain function, which affects mood, learning, concentration, and memory.
- **Turning genes on and off.** Throughout your life, your genes are constantly being regulated, or turned on or off like a light switch. Amazingly, according to a new and dynamic area of research called nutrigenomics, what we eat influences our genes. Omega-3 fats regulate genes in our brain and other parts of our body.
- **Potent power brokers.** Omega-3 fats help create highly potent substances called *eicosanoids*. Eicosanoids have an impact on a wide range of functions, including fertility, digestion, kidney function, breathing, blood flow, heart health, and immunity.
- **Fighting inflammation.** Like the nutritional equivalent of aspirin, omega-3 fats help fight inflammation and infection. This has many implications for autoimmune and inflammation disorders, including asthma, arthritis, lupus, inflammatory bowel disorders, psoriasis, cancer, allergies, and migraines.

## **Specific Roles in Your Body**

As if these activities were not impressive enough, omega-3 fats play key roles in maintaining the health of your organs. Recall the symptoms of the sick child who contracted omega-3 fatty-acid deficiency: numbness, tingling, weakness, inability to walk, leg pain, psychological disturbances, and blurred vision. These symptoms illustrate the many different body functions affected by omega-3 fats:

- **Brain.** Omega-3s help make and regulate key chemicals in the brain that affect your mood. These fats are required for growth and development of the brain, not to mention brain cell communication, which can affect learning and IQ. This role of omega-3s has many implications for mood and learning disorders, dementia, stress, and hostility.
- **Vision.** Omega-3 fats are critical for vision throughout the life cycle, from eyesight development in the womb to prevention of vision problems in the twilight years. This role has many implications for vision disorders and learning.
- **Blood.** While blood is supposed to be thicker than water, blood thickness (viscosity) can be hazardous to your health. Omega fats keep your blood flowing smoothly, which allows your heart to pump blood with less effort. Omega-3 fats also protect your arteries by keeping them elastic and flexible. This role has many implications for heart disease and stroke.
- **Heart's natural pacemaker.** Omega-3 fats help the heart maintain a steady and slower beat. This may help prevent sudden cardiac death, which is a frequent consequence of cardiac arrhythmia.
- **Sturdy bones.** Omega-3 fats help increase calcium absorption and bone formation, and they prevent destruction of cartilage, thus playing a role in preventing and treating osteoporosis.

It's not too hard to imagine that inadequate intakes of omega-3 will have some effect on every part of the body, including the brain. Clearly, omega-3s are required for a sound body and mind!

## **Omega-6 Fat Syndrome**

The last reason that omega-3 fats affect so many different aspects of your body and, ultimately, your health involves their interaction with another key group of fats, omega-6 fats. We consume omega-6s in soybean oil, cottonseed oil, safflower oil, corn oil, sunflower oil, margarines, and salad dressings.

When I was researching this book, I contacted a prominent omega-3 fat researcher at the National Institutes of Health (NIH). He began the interview by asking me a rhetorical question: "Do you know why omega-3 fats affect so many parts of our body and so many diseases?" He continued, "It's because too much omega-6 fats in our diet prevent omega-3 fats from doing their normal course of work in our body." Then he proceeded to describe how he balanced the fat in his own diet by cutting out omega-6 fats, food by food. Wow.

If you have never heard of omega-6 fat, you are not alone. When people hear the term *omega*, they often assume omega-6s are beneficial and related to omega-3 fats. While both groups of fats work together very closely, they have opposite effects in the body, like a seesaw. And as with children on a seesaw, the actions of one affect the other. If these fats are not balanced in your diet, they can dramatically affect your health. That's the problem. The American diet is bombarded with unhealthful levels of omega-6 fats, which impede the benefits of omega-3 fats.

## **Omega-6 Fats Promote Disease**

The problem with eating too much omega-6 fats is that they are disease promoting. In fact, the NIH's Essential Fats Education program makes a profound declaration on its website: excessive omega-6 fats in the diet trigger a rise in health problems, including heart attacks,

blood clots, arthritis, asthma, menstrual cramps, headaches, and tumor metastases.

Eating too much omega-6 fat is a predicament affecting most Westernized countries, not just the United States. This quandary has been documented in many cultures and is referred to as a health paradox or *omega-6 fat syndrome*.

### **Most Omega-6 Fats Are Found in “Healthy” Oils**

The paradox is that omega-6 fats have been indiscriminately promoted as “heart-healthy fats.” Many well-meaning health organizations touted “heart-healthy” oils (including corn oil, soybean oil, and margarine) to lower blood cholesterol and reduce the risk of heart disease. Consumers were (and are) urged to replace artery-clogging saturated fats in their diet with heart-smart polyunsaturated oils, *which consist primarily of omega-6 fats*.

Unwittingly, this health advice triggered people to eat more of the fats that work *against* the omega-3s. The so-called heart-healthy omega-6 oils displaced other fats in many people’s diets. Grocery store shelves overflowed (and still do) with foods containing “heart-smart” oils. But it turns out that the idea of eating polyunsaturated fats to prevent heart disease was based on an incomplete picture; emerging studies have shown otherwise. (This is discussed in depth in Chapter 5.)

Countries including Israel embraced heart-healthy eating by eating more polyunsaturated oils (omega-6 fats). Israel is especially notable because it consequently has one of the world’s greatest intakes of omega-6 fats. But with the increase of omega-6 fats came an increase in Western diseases such as cancer and diabetes.

Researchers used the term *omega-6 fat syndrome* to describe the cause of chronic illness plaguing an unusually healthy group of people in Okinawa, a region of Japan. The scientists discovered that Okinawans were eating too much omega-6 fat at the expense of omega-3 fat, and this imbalance was at the root of their new chronic health problems.

## **We Eat Fat That Did Not Exist 100 Years Ago**

Today, we eat fats that didn't exist a century ago, including cottonseed oil. Check the ingredients list on some of your favorite foods. More often than not, it will be listed, as it's among the top four oils consumed in the United States. Our foods are now filled with omega-6 fats because of technology and pressure to eat more heart-smart fats.

## **Farming Practices Increase Omega-6 Fats in Meats and Plant Foods**

Lastly, agricultural practices have dramatically altered the content of omega-6 and omega-3 fats in our diet. Plant foods used to have higher omega-3 fat levels, which had a positive trickle-down effect on the rest of our diet. In the bygone days of cattle grazing, cows used to nibble on plants containing omega-3s. And in the you-are-what-you-eat manner, these cows incorporated omega-3 fat into their own body. Voilà: the cows yielded milk and meat containing omega-3 fats, which in turn would be eaten by consumers. Today the amount of omega-3 fat in commercial beef is virtually undetectable. Instead, feedlot animals eat a grain-based diet, which offers little in the way of omega-3 but is higher in omega-6. Consequently, their meats are also higher in omega-6 fat.

## **We Need to Fix the Omega Fat Imbalance**

Indeed, the typical Western diet delivers a double whammy: insufficient omega-3 fats and too many omega-6 fats. The consequence is many chronic diseases, from osteoporosis to inflammation disorders, which we can't cure simply by reaching for a fish oil supplement. *If you have too much omega-6 fat in the diet, it interferes with the benefits of omega-3 fats!* A healthy balance of omega-6 fats and omega-3 fats in our diet is a key health factor that has been ignored for too long. Whereas our ancestors ate equal proportions of these fats, today the omega-6 fats in the American diet outnumber omega-3 fats by 10- to 20-fold!

Vegetarians are not off the hook, because studies show that they eat even more omega-6 fat in their diets than the typical person who eats meat. At the other extreme, those indulging in bacon and cream cheese in the name of weight loss, dieting Atkins style, also have a problem. These fats—saturated fats—also compete against the omega-3s.

I wrote *The Ultimate Omega-3 Diet* to help solve our fat imbalance and its ensuing health problems. I want to be clear, however, that I use the term *diet* to describe a pattern of eating, not a method for weight loss. I am strongly against weight-loss diets because of the impact on mind and body.<sup>1</sup>

*The Ultimate Omega-3 Diet* is divided into four parts. The first part of the book is a mini primer on omega-3 and omega-6 fats, including how these fats work in tandem and what happens to your health when they are out of balance in your diet. The second part of the book explains the truly astounding benefits of omega-3 fats. (Each chapter stands alone. If you want the scientific info, it's in Part 2. If you just want to know what and how to eat, you can skip this section entirely.) The research is quite stunning, showing that omega-3 fats play a key role in preventing many illnesses and conditions:

- Inflammation
- Stroke
- Allergies
- Cancer
- Alzheimer's disease

They may also be effective in treating:

- Depression
- Attention deficit disorder
- Dyslexia

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1. For more information, see E. Tribole and E. Resch, *Intuitive Eating* 2nd Ed. New York: St. Martin's Griffin, 2003.

- Cystic fibrosis
- Asthma
- Arthritis

Lastly, omega-3s have been shown to play a key role in:

- Brain development and function
- Learning and IQ

The key how-to advice in this book comes in Part 3, “How to Omega-Optimize Your Diet.” This section describes how you can get the most benefit out of your omega-3 fats, in four key steps, each delineated in a separate chapter. Chapters 10 and 11 tell you how to eat enough of two categories of omega-3 fats: short-chain and long-chain omega-3s. Chapter 12 offers advice on omega-3 supplements. And Chapter 13 addresses the other side of the fat equation: how to cut your intake of omega-6 foods.

The last part of the book, “The Ultimate Omega-3 Lifestyle,” provides makeovers, menus, and recipes balanced in their omega-3 and omega-6 fat content. The makeover section shows how to implement the steps to maximize your omega-3 fats, regardless of your lifestyle. I created menus with different themes to help with your particular eating style, from eating out to “I hate fish.” There are also nearly 40 recipes, each of which describes the omega-optimize technique, so you can apply these strategies to get the most out of omega-3s in your own favorite recipes.

Throughout the chapters, charts and tables will help you find foods that are high in omega-3 fats and low in omega-6 fats. Appendix A is a handy listing of specific foods’ omega-3 and omega-6 fat content, including the ratio of the two fats. Appendix B offers metric conversions you can apply to the recipes if you prefer to use the metric system. I’ve also included an in-depth references section, which includes the key studies and sources for the information presented in this book.

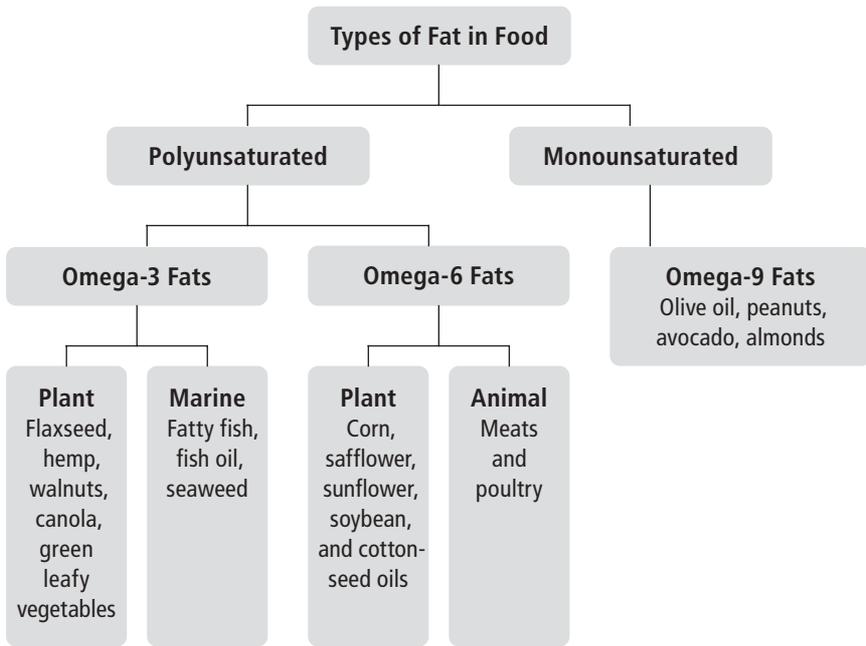
# Omega Fats Are Not Created Equal

“I THOUGHT ALL OMEGA fats are healthy.” I can’t tell you how often I hear people saying this.

While many people imagine that the term *omega* is synonymous with omega-3 fats, that impression is far from correct. It’s easy to get confused, because the fats and their names can be a bewildering tower of Babel, especially for the uninitiated. There are different omega fat families, which have completely different effects on health and disease. Even within the category of omega-3 fats, you’ll find more than one type. Then there are saturated and unsaturated fats (with the latter no longer universally viewed as *the* healthy class of fats).

How do you keep it all straight? Before we delve into the specifics of omega-3 fats and how to get them to work best for you (let alone get enough of them), let’s get familiar with the various types of fat. Figure 2.1 provides a general overview of how the different fats we eat are interrelated.

**FIGURE 2.1** Types of Unsaturated Fat in Foods



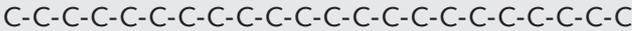
## Meet the Omega Families

*Omega* actually refers to the system of how the fatty-acid atoms are counted and named (see sidebar). Each fat family is very different from the other, as in a neighborhood, where families reside on the same street but each at a different address, which signifies a completely different household. (You don't expect the family living on 33 Main Street to be the same family living on 66 Main Street.) We will focus primarily on the omega-3 and omega-6 families, but you might like to know that olive oil comes from the omega-9 fat family, which is considered healthful.

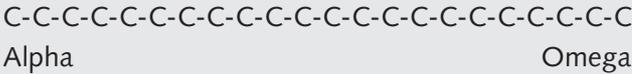
Each omega family has individual members called fatty acids, each with a different name. Each omega-3 and omega-6 fat family has a parent fatty acid, from which the other individual fats can

### What Is “Omega”?

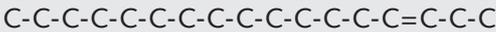
The term *omega* refers to how the various fat families are named, based on a counting system. Fat molecules are long; the typical fat molecule found in food is between 12 and 22 carbon atoms long. Think of each carbon atom as a link in a bracelet. We would represent a 22-carbon “bracelet” this way:



That’s a lot of carbons to count. To save time, scientists count from the end of the chain, where the first unsaturated pair of carbons is located (known as a double-bond arrangement). So that everyone remembers this counting system, the beginning of the chain is designated as the *alpha* side, named after the first letter in the Greek alphabet. The end of the chain is the *omega* side, named after the last letter in the Greek alphabet.



In the case of the omega-3 family, the double-bond arrangement is located three carbons from the end (the omega side):



Similarly, in the case of the omega-6 family, the double bond is six carbons from the end:



This difference may seem inconsequential, but it’s huge. It’s like the impact the location of a decimal point has on a number (especially money!). For example, would you rather have \$1.500000 or \$1500.000? Both quantities have the same digits, but the values

*Continued*

of these amounts differ considerably, just because of where the decimal is placed. The one dollar and fifty cents is like the omega-6 fats; the decimal point is six digits from the end. Likewise, the fifteen hundred dollars is like the omega-3 fats; the decimal point is three digits from the end. Just as a decimal point can make numbers far different, the location of the initial omega bond on a fat molecule makes a huge biological difference to the body.

originate. Notably, each of these parents is considered an *essential fat*, meaning the body cannot make it and it needs to be supplied by the diet. Table 2.1 identifies dietary sources of the major types of omega-3 and omega-6 fatty acids.

The individual fatty acids differ in significant ways. The omega-3 fat found in plants is very different from the omega-3 fatty acids found in seafood. *It's possible to eat plenty of plant-based omega-3 fats but still be deficient in the other omega-3 fatty acids found in marine foods.* This is a big source of confusion for consumers. Here's a brief description of the key omega-3 fatty acids:

**TABLE 2.1 Omega-6 and Omega-3 Fats at a Glance**

	<b>Omega-3 Family</b>	<b>Omega-6 Family</b>
<b>Omega parent</b> (essential fatty acid)	<i>Alpha-linolenic acid (ALA)</i> : flax oil, canola oil, hemp, green leafy vegetables like spinach, walnuts	<i>Linoleic acid (LA)</i> : soybean oil, corn oil, safflower oil, sunflower oil, cottonseed oil
<b>Omega potent kids</b> (biological power brokers)	<i>Eicosapentaenoic acid (EPA)</i> and <i>docosahexaenoic acid (DHA)</i> : fatty fish and their oils, some seaweeds, enriched foods	<i>Arachidonic acid (AA)</i> : meats and poultry

- **Alpha-linolenic acid (ALA).** The parent of all the fatty acids in the omega-3 family is known as alpha-linolenic acid (ALA). Technically, all the omega-3 fatty acids can be made or originate from ALA, but research shows that this is rarely the case. ALA is one of the shortest among the omega-3 fats, making it a short-chain fatty acid (see Table 2.2). ALA is found in plants, green leafy vegetables, flax oil, canola oil, and hemp.
- **Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA).** EPA and DHA are known collectively as long-chain fats and are found primarily in fish and fish oil. Stories about the marvelous benefits of omega-3 fats usually involve one (or both) of these powerful fatty acids.

Here’s the problem. Although laboratory tests showed that ALA can be made into EPA and eventually DHA, recent studies on humans indicate that this is not what the human body actually does. Therefore, you cannot assume that if you eat the parent form of omega-3 fats, ALA, it will indeed create EPA and DHA. If you take flaxseed oil supplements or eat a lot of flax foods as your primary source of omega-3 fats, they provide ALA, but you could still be deficient in EPA and DHA. In fact, the latest research shows that less than 1 percent of ALA gets made into EPA, and seldom (if ever) does it make DHA. That’s why many researchers believe that all three of these omega-3 fats are essential.

**TABLE 2.2 The Key Omega-3 Fats**

Fatty Acid	Category	Size	Main Sources
Alpha-linolenic acid (ALA)	Polyunsaturate	Short-chain	Plants
Eicosapentaenoic acid (EPA)	Polyunsaturate	Long-chain	Fish
Docosahexaenoic acid (DHA)	Polyunsaturate	Long-chain	Fish

## Meet the Omega-6 Fat Family

Omega-6 fats, when eaten in excess, can cause a variety of health problems. The omega-6 fat problem is a bit like Americans' excess consumption of salt (sodium). Sodium is a nutrient that is very easy to get in the diet without ever lifting a saltshaker. Similarly, omega-6 fats are in nearly every food we eat, so we really don't need to make an extra effort to eat them. Here's a brief description of the key omega-6 fatty acids:

- **Linoleic acid (LA).** The omega-6 parent, linoleic acid (LA), accounts for the majority of polyunsaturated fats in the American diet and is considered an essential fat. (Yes, you are reading this name correctly; it is remarkably similar to the omega-3 fat parent, alpha-linolenic acid.)
- **Arachidonic acid (AA).** Arachidonic acid can be found in animal products but is readily made from the parent omega-6 fat, LA. (This is unlike omega-3 fats, where there is limited conversion of the parent to its potent "kids.") Too much of this fat in the body can trigger inflammation and cause blood clotting. AA is also known as the long-chain omega-6 fatty acid.

## Fat Family Rivalry: Omega-6 Versus Omega-3 Fats

Both omega-3 and omega-6 fats make powerful substances in your body that play key roles in the structure and function of *every* cell and ultimately your health and well-being. But they are chemically distinct families with opposite effects on your body. For example, a diet high in omega-6 fats promotes blood clotting, while omega-3 fats prevent the blood cells from clumping. Omega-6 fats act to raise blood pressure, while omega-3 fats work to lower blood pressure.

Once you eat these fats and they enter your body, they are in direct competition with each other. Like rival gangs, both of these fat families compete for the same limited resources (enzymes) to make their subsequent potent compounds. The bigger family will

“win” the resources that ultimately shift your body toward health or disease.

### **Saturated Versus Unsaturated Fat: A Big Difference to Your Health**

No fat that you eat, whether oil or butter, is made up of just one particular type of fatty acid. For example, butter is known as a saturated fat (and indeed has a high level of this fat), but as shown in Table 2.3, it still has a bit of polyunsaturated and monounsaturated fats. Olive oil is known as a monounsaturated fat but contains some saturated and polyunsaturated fat. And canola oil is 7 percent saturated fat, 59 percent monounsaturated fat, and 30 percent polyunsaturated fat. Its polyunsaturated fat consists of 69 percent omega-6 fat and 31 percent omega-3 fat.

Fats commonly thought of as healthful are not necessarily so. Researchers realize that it is no longer adequate to assume that all fats within a class behave the same way in our bodies. This is especially true for polyunsaturated fats, including omega-3 and omega-6 fat families. But let’s begin with the saturated fats, as little has changed—they are still widely considered a health problem.

**TABLE 2.3 Comparison of Dietary Fats in Common Oils and Butter**

Oil	Saturated %	Monoun-saturated %	Polyunsaturated Fat		
			% Total	%Omega-6	%Omega-3
Butter	51	21	3	90	0.3
Canola oil	7	59	30	69	31
Corn oil	13	28	55	98	2
Flaxseed oil	9	20	66	19	81
Olive oil	14	73	11	93	7
Soybean oil	14	23	58	88	12

## Saturated Fats

The saturated fats are the infamous artery-clogging fats that raise blood cholesterol. They are called “saturated” because of how their carbon atoms are connected. (Technically, they are 100 percent *saturated* with *hydrogen* atoms.) These fats are found in animal products, including meats, poultry, dairy products, eggs, and butter, and in some plant foods, including palm oil, palm kernel oil, and hydrogenated vegetable oil. Our bodies have no need for saturated fat. Saturated fats interfere with the beneficial effects of omega-3 fats in the body.

## Unsaturated Fats

Unsaturated fats may be monounsaturated or polyunsaturated. *Monounsaturated fats* have one pair of carbon atoms that are not saturated with hydrogen atoms (hence the term *mono*). They include

### Hydrogenation: How Food Manufacturers Turn Polyunsaturated Fat into Saturated Fat

When food manufacturers add hydrogen to PUFA oil, it becomes *hydrogenated* oil. This chemical process converts oil into a saturated fat (saturated with hydrogen), which makes the oil hard or solid. These fats have typically been used in foods where a firmer texture is preferred, such as stick margarine.

During hydrogenation, *trans fats* are created. These nefarious fats are created when oil is partially hydrogenated. The oil's chemical architecture is twisted into a “trans” configuration, which is like taking the two wheels on a bicycle and contorting them. As a result, you still have a bike with two wheels, but the ride is bumpy and potentially dangerous. These fats trigger double trouble for the heart: they raise LDL (bad) cholesterol and lower HDL (good) cholesterol. Trans fats also compete and interfere with omega-3 fats in the body.

olive oil, which is the dominant type of this fat in the diet. Canola oil also is high in monounsaturated fat. Monounsaturated fats are generally recognized as healthful types of fats.

*Polyunsaturated fatty acids (PUFAs)* have at least two pairs of carbons that are not saturated with hydrogen. Polyunsaturated fats come in different lengths, known either as short or long chain, based on the number of carbons.

A polyunsaturated fatty acid with at least 20 carbon atoms is a *long-chain polyunsaturated fatty acid*. For example, the plant source of omega-3 fat, ALA, has 18 carbons and is considered a short-chain PUFA, while EPA has 20 carbons and is considered a long-chain PUFA (DHA has 22 carbons). Omega-3 and omega-6 fats are both polyunsaturated; EPA and DHA are long-chain omega-3 fats, and arachidonic acid (AA) is the long-chain omega-6 fat.

For a quick summary of these categories and their effects on health, see Table 2.4.

**TABLE 2.4 How the Different Fats Affect Health and Omega-3 Function**

Type of Fat	General Health Effect	Effect on Omega-3 Function in the Body	Food Sources
Saturated fat	Negative	Negative	Full-fat dairy (such as butter, ice cream), meats, palm oil, poultry fat (skin)
Monounsaturated fat	Positive	Neutral	Olive oil, canola oil
Polyunsaturated fat: omega-3	Positive	Positive	Fatty fish, walnuts, flax, hemp, green leafy vegetables
Polyunsaturated fat: omega-6	Negative when in excess (main contributor to inflammation); lowers cholesterol	Negative	Corn oil, safflower oil, sunflower oil, soybean oil, cottonseed oil, traditionally raised meats and poultry
Trans fat	Negative	Negative	Fried foods, shortening

In the next chapter we will take a closer look at why the balance between the omega-6 and omega-3 fats is so important to your health.

## Summary of Chapter 2

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**T**here are three classes of dietary fats that are found in foods we eat.

- Saturated fats are found primarily in animal foods and tropical oils; they are considered unhealthy.
- Monounsaturated fats are found primarily in olive oil and are considered healthy.
- Polyunsaturated fats are found in many plant foods and seafood.
- No fat or oil we eat is made up of just one of class of fats.

**Polyunsaturated fats are made up of two distinct fat families:**

- Omega-3 and omega-6 fats are polyunsaturated fats, which have opposite effects in the body.
- Each omega “family” is “headed” by an essential fatty acid, fats that our body cannot make.

**There are three key fatty acids that make up the omega-3 fat family.**

- The essential fat or parent fat is alpha-linolenic acid (ALA), which is a short-chain omega-3 fat found in flax, walnuts, hemp, green leafy vegetables, and canola oil.
- The long-chain omega-3 fats are EPA and DHA and are the most potent and beneficial omega-3 fats. These fats are found mainly in seafood.

- ALA eventually gets made into EPA and DHA (ALA⇒EPA⇒DHA).
- Omega-3 fats have a positive effect on health.

**There are two key fatty acids that make up the omega-6 fat family:**

- Linoleic acid (LA) is an essential fatty acid and the parent of the omega-6 fats. It is found in nearly every food but especially soybean oil, corn oil, safflower oil, margarines, salad dressings, sunflower oil, and cottonseed oil.
- Arachidonic acid (AA) is the potent long-chain omega-6 fat. Our body easily makes it from LA (LA⇒AA). AA is also found in animal foods.