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Ketogenic Keys to Good Fats, Bad Fats and Great Health

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Fact Checked

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STORY AT-A-GLANCE

- Just over 100 years ago, we began consuming industrial vegetable oils that never existed before. These oils are primarily damaged omega-6 linoleic acid. As a result, our omega-6 intake nearly tripled, while our intake of plant- and marine-based omega-3 fat decreased tenfold
- Damaged omega-6 fat is integrated into your cell membranes, including the mitochondrial membrane, and once these membranes become dysfunctional, complications follow
- The fluidity of the cell membrane is extremely important as it houses hormone transporters. When you don't get enough marine-based omega-3 fats, especially docosahexaenoic acid (DHA), the membranes become very rigid
- You only need around 1 to 2 grams of omega-6 linoleic acid per day, ideally from plant seeds and tree nuts, whereas optimal levels of marine omega-3 fats are around 3 to 4 grams per day, which can be obtained from small fatty fish such as anchovies, sardines, herring, wild-caught salmon or krill oil
- Saturating your cells with DHA makes their membranes very fluid, thereby raising your basal metabolic rate by 15 percent, and increasing your fat burning capacity during exercise by 30 percent. Even at rest, your fat burning goes up by 20 percent

Editor's Note: This article is a reprint. It was originally published November 11, 2018.

I've previously interviewed **James DiNicolantonio, Pharm.D.**, about his book, "**The Salt Fix: Why the Experts Got It All Wrong and How Eating More Might Save Your Life**," where he exposes why we got it wrong about salt and promotes eating healthy real salt.[1]

"The Salt Fix" is a fascinating book and I encourage you to go pick up a copy and read it. Here, we will focus on our new book, "**Superfuel: Ketogenic Keys to Unlock the Secrets of Good Fats, Bad Fats, and Great Health**," which covers the importance of dietary fats, and how to discriminate between healthy and harmful fats.

DiNicolantonio compiled most of the research for this book and invited me to contribute to it, which I was happy to do. Healthy fats are the foundation of my last book, "Fat for Fuel," and I thought it would be useful to expand on the topic with this book.

> *"'Superfuel' is the ketogenic diet 2.0,"* DiNicolantonio says. *"Everyone's doing keto diets now, where their diets are mostly 70 to 80 percent fat. But, 'How do we enhance that diet? What are the healthy fats? What type of fat should people be eating since it's making up the majority of their calories?'*
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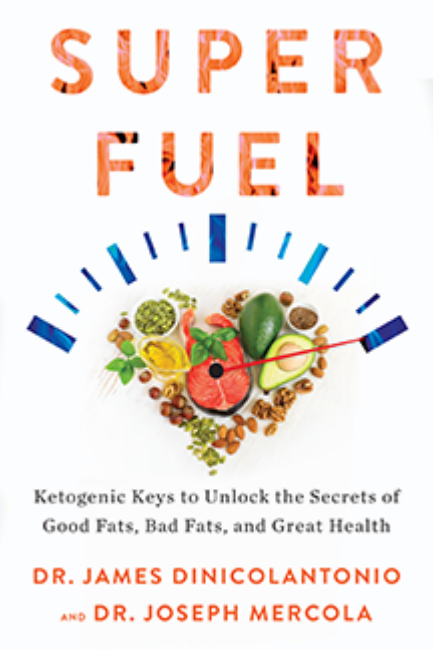
> *I think a lot of people doing the ketogenic diet are doing some things right, but they're doing a lot of things wrong … That really was the motivation for this book."*



What's Gone Wrong With Our Modern Diet

In a nutshell, "Superfuel" guides you back to a diet closer to what was eaten during Paleolithic times. Just over 100 years ago, Procter & Gamble introduced Crisco as an alternative to butter and lard in 1911, and we began consuming industrial vegetable oils or seed oils that never existed before.

These oils are primarily omega-6 linoleic acid, and damaged omega-6 at that, due to the processing involved. As a result, our omega-6 intake nearly tripled, while our intake of plant- and marine-based omega-3 fat DECREASED tenfold, causing a severe imbalance in our omega-3 to omega-6 ratio, which ideally should be between 1-to-1 and 1-to-5. DiNicolantonio says:

> *"We've had these dramatic changes in our fat intake. They actually changed us from the inside out. Omega-6 isn't bad as it is an essential fat. It's only when you isolate it and adulterate and consume it in excessive quantities that it becomes pernicious. We have these bottles of omega-6 now that are … exposed to light, and then we cook with them. That oxidizes the oil further.*
>
> *Then we consume these isolated oils. They don't have the natural vitamins and minerals and antioxidants in the coatings around seeds and nuts that gives us omega-6 to protect them from oxidizing in our body.*
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> *When you consume these isolated oils, even if it's a cold-pressed omega-6, the acid in your stomach will oxidize those oils and create lipid hydroperoxides and aldehydes. We absorb these and they cause a ton of damage."*

How Damaged Omega-6 Fat Causes Cellular Damage

Indeed, one of the most significant dangers from consuming processed vegetable oils is that the damaged fats are integrated into your cell membranes, including the mitochondrial membrane, and once these membranes become dysfunctional, complications are sure to follow.

Even if you do not cook with canola oil or some other vegetable oil, there are many other stealth or hidden sources of damaged omega-6s. If you frequent restaurants on a regular basis, for example, you're virtually guaranteed to be eating a high-omega-6 diet, as most restaurants use vegetable oils in their cooking and baking.

> *"Canola oil is one of the worst oils you can cook with,"* DiNicolantonio says. *"It causes a ton of oxidation products, because they're so susceptible to heat due to the double bonds. They put these omega-6 seed oils in bread and in condiments, cereals, pastries and desserts. It's really everywhere … [and] it's literally transforming you from the inside-out, because these long-chain omegas get integrated in the cell membrane.*
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> *The oxidation products oxidize those fatty acid tails. When you damage those tails in the lipid bilayer, they start to curl upwards. That actually creates a more permeable membrane. You get more things that aren't supposed to get into the cell and damage the mitochondria, damage the DNA. The fluidity of the cell membrane also goes down.*
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> *The fluidity of the cell membrane is extremely important, because you have all these hormone transporters that sit in the cell membrane. When you don't get enough omega-3s, especially docosahexaenoic acid (DHA), the membranes become very rigid …*
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> *Instead of being able to come in and out very easily, because the membrane isn't fluid, it starts … affecting how things flow into and out of the cell. Your metabolic rate goes down, and you have damage in the cell. It's a huge issue."*

DHA Is Crucial for Cellular Health

With regards to your **mitochondria**, these organelles have an inner membrane. Cardiolipin is an important component of this membrane and it needs to be saturated in DHA, which happens to be very susceptible to oxidation. Cardiolipin can be likened to a

cellular alarm system that triggers apoptosis (cell death) by signaling caspase-3 when something goes wrong with the cell.

However, if the cardiolipin is not saturated with DHA, it cannot signal caspase-3, and hence apoptosis does not occur. As a result, dysfunctional cells are allowed to continue to grow, which can turn into a cancerous cell. Similarly, in your brain, DHA is used as a signal to stimulate NRF2, heme oxygenase 1 and to upregulate antioxidant enzymes.

> *"Omega-3s oxidizing in the body is bad, but our bodies kind of know what to do with that signal, whereas omega-6, not so much, because we didn't have as much during Paleolithic times,"* DiNicolantonio says.

Lowering your omega-6 intake is also important for the removal of senescent cells, i.e., aged, damaged or crippled cells that have lost the ability to reproduce. If senescent cells are not removed, they start gunking up the machinery. Fasting is another method that will clear out senescent cells.

Dietary Recommendations Are Way Off on Omega-6

When it comes to omega-6, you really only need 1 to 2 grams of linoleic acid per day. I like my primary sources of omega-6 to be whole foods such as nuts and seeds. With the exception of flax seeds, chia seeds and hemp seeds, most other plant seeds have high amounts of omega-6

Meanwhile, the American Heart Association (AHA) recommends you to consume 5 to 10 percent of your calories as omega-6 from vegetable oils or olive oil. DiNicolantonio explains:

> *"Instead of recommending whole foods, they recommend oils, which makes absolutely no sense. The Lyon Diet Heart Study*[2] *lowered linoleic acid from over 5 percent to about 3.5 percent [and found] a 70 percent reduction in cardiovascular [problems] and mortality.*

There's actually no evidence to support the AHA or the United States dietary guidelines, [which] recommends consuming high amounts of omega-6s from vegetable oils …

The problem with these industrial seed oils is the processing that occurs to get [the oil] out of the seed. They have to use hexane and deodorize the oil, because it's so toxic. By the time it makes it to the shelf, you've got all these oxidation products, and then you consume it and your body oxidizes it with the acid in your stomach.

These oxidation products are about a fiftyfold higher than the eicosanoids made in your body. They are dramatically more harmful than any of the most harmful eicosanoids, like thromboxane a2 … because they form aldehydes. These aldehydes, like 4-hydroxynonenal … is what actually causes oxidized low-density lipoprotein (LDL).

It binds to the apolipoprotein B (apoB) [and] all apoB-containing lipoproteins. Now, these lipoproteins aren't recognized by the LDL receptors. They hang out in the blood. It's really the linoleic acid that gets integrated into high-density lipoprotein (HDL), LDL and very low-density lipoprotein (VLDL), [which then] oxidizes and causes atherosclerosis.

Linoleic acid itself also damages the endothelium and causes an increase in penetration of LDL and VLDL particles into the subendothelium … And then when you get these oxidation products, it's dramatically more harmful.

This is what's causing neurodegenerative diseases. Aldehydes can actually crosslink tau protein and create neurofibrillary tangles. It has been shown in animal studies that these aldehydes can literally create neurofibrillary tangles that you see in Alzheimer's disease.

This is what's called advanced lipoxidation end-products (ALEs). Most people know about advanced glycation end-products (AGEs), but these ALEs, by far, are

much more harmful, and it's caused by consumption of oxidized omega-6 seed oils."

Healthy Versus Damaging Omega-3 Fat

It may come as a surprise to learn that all omega-3 sources are not healthy either. Not only is the ratio between omega-3 and omega-6 a primary concern, but industrially processed omega-3 products can also cause problems similar to those caused by too much, and damaged, omega-6. This is a topic we delve deeper into in the book.

For example, about half of all fish oils have problems with oxidation. So, when buying a fish oil supplement, you really need to look for a product that tests the hydro peroxide levels. The lower the level the better, but I would not accept anything over 5 percent.

Many fish oils are also not sourced from wild fish, and that's another consideration. Ideally, you really want a fish oil obtained from wild-caught fish and not farmed. Also avoid farmed fish such as farmed salmon if you're using that as a direct omega-3 source.

Many times, farmed salmon are raised on an unnatural diet that raises their fat content to abnormal levels and skews their omega-3 to omega-6 ratio in favor of the latter. They're also **chockfull of toxins**. Along with wild-caught salmon, other healthy sources of omega-3 are sardines, anchovies and herring.

In addition to that, there's the issue of sustainability, where both wild-caught and farmed fish fall short. That's one of the reasons I like krill oil, because it is the largest biomass in the world, and harvesting is tightly regulated. If you're a vegan and refuse to eat any animal food at all, your choices become very limited. Perhaps one of the best sources of EPA and DHA for vegans is algal oil.

"Krill is great, because it is very sustainable and has so many advantages compared to just regular fish oil, because the omega-3s are bound to phospholipids," DiNicolantonio says. *"Back in Paleolithic times … we were*

scavengers. Sites have been discovered from over 2 million years ago with dozens of animal skulls cracked open around them.

The brain is higher in DHA than salmon — up to 30 percent more concentrated. So, our ancient ancestors were able to access and scavenge skulls in the African savanna and get tremendous amounts of DHA. To give you an example, 4 ounces of brain can give you up to 1.5 grams of DHA.

It's extremely saturated in cholesterol as well. This was a phospholipid-bound DHA that we were getting. And your brain doesn't absorb DHA without it being bound to phosphatidylcholine … When you're consuming fish oil, you've got to esterify it. You've got to attach it to choline, and then you absorb it.

But with krill oil, being bound to the phospholipids, you get twice the absorption of DHA … And then, also, our consumption of ALA was 10 times what it was today. How we used to get omega-3s if we weren't getting brain or seafood is we were consuming a tremendous amount of plant material.

We were getting 10 to 15 grams of alpha-linolenic acid (ALA). That's the parent omega-3 in plants. We only get about 2 grams nowadays. If you look at a female of childbearing age, they could convert over 20 percent of their ALA to EPA …

[A woman of childbearing age] can convert almost 10 percent of that ALA to DHA, which is a long-chain marine omega-3. They were getting 1 to 1.5 grams of DHA just from the conversion."

Bear in mind that these conversion rates are not typical. The average, nonpregnant adult typically converts only 5 percent ALA to EPA and 0.5 percent ALA to DHA.

What's more, when you go from 15 grams of omega-6 linoleic acid to 30 grams, which we're consuming nowadays, that reduces your conversion rate of ALA to EPA and DHA by another 40 to 50 percent. Certain nutrients, including magnesium and gamma-linolenic acid (GLA), are also required, so certain nutritional deficiencies play a role in your ability to convert ALA to EPA and DHA as well.

The Importance of Animal-Based Omega-3 in Fat Burning

In regard to the **ketogenic diet**, most people don't understand how important omega-3s are to building muscle, improving fitness and burning fat. To give you an example, if you replaced just 6 grams of visible fat in your diet (such as steak) with 6 grams of high-quality fish oil, research shows that in just three weeks you may lose 2 pounds of fat and gain half a pound of muscle. The reason for this is because omega-3 fat, particularly DHA, is the pacemaker of the cell.

> *"The reason why hummingbirds can beat their wings 80 times a second is because they can saturate their wings with DHA,"* DiNicolantonio says. *"DHA makes the cell membrane so fluid that molecules, like amino acids, glucose, sodium, potassium, they fly in and out of the cell.*
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> *The same thing happens in humans. When you consume a high amount of omega-3s, about 3 to 4 grams, you create a cell membrane that is super saturated DHA, very fluid. Now, your basal metabolic rate goes up 15 percent. Your beta-oxidation in the liver during exercise, your fat burning during exercise goes up by 30 percent. Even at rest, your beta-oxidation goes up by 20 percent.*
>
> *Long-chain omega-3s are important for ketogenic diets, because you become a better fat-burning machine. It's affecting the machinery, the beta-oxidation in the liver. It's improving that by activating genes. And then the other omega-3, the plant omega-3, ALA, is a ketogenic substrate, so it doesn't get stored like the marine omega-3s. It can be converted into ketones …*
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> *Medium-chain triglycerides (MCT) oil is great too for fat loss. Meta-analyses or randomized studies show that MCT oil, compared to long-chain saturated fats — we're talking about heavy cream and butter —significantly reduces waist circumference and visceral adiposity, because it doesn't get stored. It gets burned for ketones.*
>
> *The reason why [marine-based] omega-3s are good for fuel is because it suppresses inflammation in the brain. What happens in a cognitive-declining*

brain is you're not able to utilize glucose well, because of the inflammation. DHA helps squelch the inflammation.

Your brain is able to utilize glucose better when you're consuming more omega-3s. You're actually able to produce more ketone bodies when you're consuming both parent omega-3 and the long-chain EPA and DHA. You become a better ketogenic machine when you're consuming high amounts of omega-3s."

Mechanisms Behind Omega-3s Ability to Optimize Fat Burning

The mechanism behind these effects is an upregulation of genes that activate beta-oxidation in your liver, allowing you to burn fat more efficiently when you have enough omega-3s in your system. Overall, your basal metabolic rate goes up, because your cell membranes are so fluid, which allows amino acids and glucose to flow into and out of the cells better.

Your inflammation also goes down, and all of this helps optimize your ability to burn fat for fuel. On top of that, omega-3s help synthesize protein, so muscle protein synthesis dramatically increases when you consume 3 to 4 grams of animal-based omega-3 per day — again, because amino acids are able to circulate through the cell very easily when its saturated with DHA.

"Studies have shown in middle-aged adults, as well as in the elderly, consuming 3 grams of DHA [per day] increases muscle strength, increases your maximum amount that you're able to rep. Your grip strength is improved. This is an important fat to help prevent sarcopenia.

This is a very big issue, where elderly people are not even able to carry a milk carton. Really, the omega-3s are what's going to hopefully help prevent a lot of the muscle loss during aging."

Recent Study Supports Our New Book — 'Superfuel'

After taping this interview, the drug company Amarin issued a press release[3] about a new study with fish oil that was just recently completed. They used a new proprietary prescription formulation of fish oil called Vascepa. This is a highly-processed form of EPA.

The drug trial was called REDUCE-IT and it was done for five years. The really unusual result of this trial is that they used high doses — 4 grams per day — which is two to four times as much EPA as is typically done in these types of studies.

What did they find? They found a 25 percent reduction in cardiovascular risks, which far exceeded their expectations and results that are seen with statins. The study only looked at cardiovascular disease but my guess is other degenerative diseases, like Alzheimer's, diabetes and arthritis, also likely improved. We won't be able to review the study until it is presented at the American Heart Association's annual meeting on November 10, 2018.

This study confirmed what we wrote and predicted in our book that will be published on November 13. BUT here is the real kicker, the drug costs $2,500 per year or over $200 per month. Krill and clean fish are far less expensive but you need to approach the 4 grams per day dose to achieve these results, which is the key.

More Information

In closing, this has been but a small sampling of what is covered in greater depth in "**Superfuel: Ketogenic Keys to Unlock the Secrets of Good Fats, Bad Fats, and Great Health**," which can be preordered from **Amazon** or **Barnes & Noble**. It's a great complement to "**Fat for Fuel**," and will help you clearly understand the benefits of these vitally important fats.

Follow Dr. James DiNicolantonio on **Facebook**, **Twitter**, and **Instagram** for more information. Pick up a copy of his book, "**The Salt Fix: Why the Experts Got It All Wrong and How Eating More Might Save Your Life**."

Sources and References

- [1] Amazon.com Real Salt
- [2] Circulation April 3, 2001; 103: 1823-1825
- [3] STAT News September 24, 2018