

Linoleic Acid: A Potentially Toxic Metabolic Poison?

A Special Interview With Tucker Goodrich

By Dr. Joseph Mercola

Dr. Joseph Mercola:

Welcome everyone, this is Dr. Mercola helping you take control of your health. And today we are delighted to be with Tucker Goodrich who is going to participate in discussion on one of the most exciting developments in helping you achieve your health and prevent the devastation, the epidemic of chronic disease that we've encountered over the last century. And it's a topic that most interested clinicians or health care practitioners who focus on natural medicine understand, but only superficially, including me, until earlier this year. I didn't get it. I didn't understand that there's a refinement and application of this avoidance of this potentially toxic metabolic poison that virtually everyone doesn't understand and is radically exposed to. And that toxin is a special fat, typically considered to be an essential fat, called linoleic acid. It's an omega-6 polyunsaturated fat, which you may or may not have heard about, but once you're finished with today's dialogue, you're going to be stunned. So with all that preface, welcome, and thank you for joining us this morning, Tucker.

Tucker Goodrich:

It's a pleasure Dr. Mercola, really nice to meet you finally after our many back and forths over email preparation for this.

Dr. Joseph Mercola:

Yeah, because as I mentioned in my intro, I, like most other clinicians who value nutritional interventions to optimize health understand that vegetable oils, which are loaded with this poison, are something to be avoided. I don't think that's noncontroversial and indisputable, but what's failed to appreciate is even if you eliminate the vegetable oils and you avoid them like the plague, you're still not hitting the mark. There is a massive likelihood that you are taking too much of this dangerous fat.

Dr. Joseph Mercola:

So we're going to go into the details. And if you listen to this whole dialogue and conversation, you will understand why, I can assure you, because Tucker's agreed to stay on for as long as we need to help you understand this. So before we go there, I want people to understand what your background is and then we can dive into how come you were so far ahead of the curve figuring this thing out when so many of us, me included, missed it. So let's go with your background first.

Tucker Goodrich:

My background is on Wall Street. I started out as a stockbroker actually, pretty quickly decided I wasn't cut out for that, switched over to the asset management side of the business and then into the hedge fund side of the business, first as a trader and then increasingly got into IT and the risk management side of the business. So I wound up — at one point two of the 100 biggest hedge

funds in the world were running on systems that I built and I ultimately winded up designing and running for a long period of time, an enterprise risk management system.

Tucker Goodrich:

And I was largely self-taught in technology. So I was good at researching, figuring out how to do things correctly and doing a lot of troubleshooting and debugging. I wound up with a staff of 20 odd people, including a lot of academic comp side people who I supervised and helped with troubleshooting. So I got very good at figuring out what was causing problems and ideally figuring out how to avoid having those problems occur in the first place. So when I was going along happily doing that and-

Dr. Joseph Mercola:

You didn't mention one bit of professional health care training or studying to interpret the medical literature. So how did you get that expertise?

Tucker Goodrich:

Well, I was one of these guys who – I'd been really interested in science and biology when I was a kid so I always had kind of a bent to apply the scientific method, which was mostly what I did at work. It was all just engineering, applied scientific method. When I was in my late 30s, I started getting quite sick. The first thing that happened to me was I had what was initially diagnosed as being a stroke. And I was unable to talk while I was at work, about 30% of my vision disappeared.

Tucker Goodrich:

Luckily one of the fellows who worked for me had been an EMT (emergency medical technician) and diagnosed it as a TIA (transient ischemic attack) and drove me to the local stroke hospital, Westchester Medical, which is supposed to be one of the best in the country. And I spent the next four days there being poked at by medical students and a very talented neurologist who is their stroke specialist and they said the thing you never want to hear when you're in a hospital, "Wow, this is fascinating. We never see anybody your age in the stroke ward. They're usually old people." I'm 38 years old. This is not supposed to be happening to me. I come from a healthy family, my grandparents and my parents all lived into their 80s and 90s, so this just was not supposed to be happening at 38 years old.

Tucker Goodrich:

So I got out, ultimately, that's when I started doing the medical research. I was able to get the doctor to change his diagnosis ultimately from stroke to a migraine. And if you didn't know that a migraine can leave you with a semi-permanent speech impediment, I didn't either, but apparently it does happen to people. Luckily that speech impediment has healed over time.

Dr. Joseph Mercola:

They're almost identical in presentations, migraines. I mean, it's very difficult to differentiate between them without some type of imaging study.

Tucker Goodrich:

So his comment to me, now this was a professor of neurology at a teaching hospital, his comment to me was that he'd never changed a diagnosis because of research presented to him by a patient. So that was kind of cool. And he was wonderful, he invited me into his office one Friday evening for several hours and walked through the whole pathophysiology of stroke and talked to me about all of my symptoms and what was going on in my family. My wife at the time, fascinatingly, had two weeks previously also had something that was diagnosed as a stroke initially and had also spent four days in a stroke ward. So the fact that this happened to both of us almost contemporaneously pointed strongly at something that was environmental, but we didn't have a clue what it could have been at that point.

Tucker Goodrich:

Two years later, I came down with acute diverticulitis. In the interim, I was having increasingly bad autoimmune problems. I'd always had allergies and asthma, but I started just reacting to things, like I had a reaction to penicillin that led to an initial later corrected diagnosis of a penicillin allergy. I had borderline osteoporosis, osteopenia, I'd broken six bones over the course of two years. A lot of stuff was going wrong. And I remember distinctly one day looking in the mirror in my bathroom and thinking to myself, "Dude, you look old." And I just thought it was age. I wound up having a colon resection because of the diverticulitis, but the symptoms continued.

Tucker Goodrich:

So, a very upsetting time in my life and medical professionals really weren't any help at all in trying to figure out what caused things. For the diverticulitis, I got the typical, "You need to eat more fiber," and I did so and it got worse leading ultimately to the colon resection and then symptoms continued. So I kept doing a lot of research. I mean, I took up running, right? Because running was the one thing that was shown in the medical research to inversely correlate with diverticulitis. So I said, "Okay, fine. I'll start running." And I had all sorts of problems with shin splints, got into this barefoot running movement.

Dr. Joseph Mercola:

Tucker, Tucker, can you hear me?

Tucker Goodrich:

Yes.

Dr. Joseph Mercola:

What year was this all, when you started this process?

Tucker Goodrich:

So that would have been from 2006 up to 2009. So over the course of a number of years. So then one day a friend of mine who I'd met through this barefoot running movement sent me a link to a scientist blog. At the time he was still a Ph.D. student, Stephan Guyenet, and Stephan went through how diet affected dental problems. Now I'd had all sorts of, eight teeth pulled, countless cavities when I was a kid and reading this blog and realizing that all of that had basically been optional, that blew my mind. I mean, I don't like going to the dentist and finding out that all my

dental problems were totally the result of bad diet and not genetics as I had always been told, and that I could choose not to have this really resonated with me because thanks to a dentist, I'd stopped eating sugar 20 years before and had been able to completely eliminate my cavity problem over the next 20 odd years.

Tucker Goodrich:

So I was very receptive to that. And then I started reading this blog more and more, and not just reading the blog, but following all of his references and reading all the papers. And he sort of guided me in what I should be reading, which led me one day to taking a first step that nobody does and trying to fix their diet, which was cutting out seed oils, standing there at the salad bar in the office cafeteria one day, I just said, "You know what? This has got to be the worst, nastiest, cheapest stuff, looking at all these squeeze bottles full of salad dressing." And I said, "I'm going to stop eating them today." Two days later, my 16-year long bout with irritable bowel disease ended and the chronic diarrhea that I had been suffering with for all of these years, chronic to the point where I had to travel with a roll of toilet paper in my backpack just to be safe, disappeared. And I started immediately feeling better. And we can go through some of that as we get into what parts of chronic disease does this affect.

Tucker Goodrich:

But I, in short order, lost all my excess weight over the next two months, it just fell off me. Everybody looked at me as a result of that. I stopped eating carbohydrates and realized I had a severe gluten intolerance. And again, being an engineer by trade, I did a lot of experimenting, "What can I eat? What can't I eat? What brings back the symptoms? What do I have to avoid to keep the symptoms away?" And it was a sort of transformation that made everybody who I worked with comment on what a difference they saw in me in very short order. It was a very quick change.

Dr. Joseph Mercola:

Okay. Well, thank you for that backstory and helping us understand what motivated you to become a researcher essentially, and a teacher of what was going on and continues to go on and affects large amounts of our population. So definitely improvements with still the interventions you had back then were not too surprising. I mean, there are many, many people who teach avoiding seed oils now and processed foods in general and probably would have gotten that. But I think as to the next extreme, we ought to understand this. So you focus on the seed oils, I think it sounds largely, through Stephan's work, which is great, but then what motivated you to continue going on? And, well, actually let's skip that, we can integrate that into the rest of the discussion of which is, for whatever reason you chose to focus on the seed oils and the linoleic acid. So maybe-

Tucker Goodrich:

Not initially, actually. I didn't realize initially that was the-

Dr. Joseph Mercola:

When did that understanding or epiphany occur?

Tucker Goodrich:

I mean, I'd had an immediate reaction — positive, immediate reaction — to cutting it out of my diet. So I knew that there was something going on there, but there wasn't really an understanding. As you mentioned, a lot of people said that you should avoid seed oils, but nobody ever said “Why?” Nobody really got into the mechanisms of “why,” right? And what I started looking into is the why, “Why did it have this effect on me,” right? I tried going low-carb to lose weight before, I'd never been able to do it successfully because of the carbohydrate cravings that I would suffer. And this time along, I just forgot to eat any carbohydrates for a week.

Dr. Joseph Mercola:

But there is a “why” offered, explanation to the why, which still persists to this day is that balancing of the omega-6 to omega-3 ratio. I mean, that's been taught for decades. So I mean, that would be the justification for elimination of the seed oils because you can't have massive amounts of omega-6. And even to this day, many people think, “Oh, the solution for too much omega-6 is increase the omega-3,” while that is a dangerous, dangerous strategy.

Tucker Goodrich:

That's exactly right. The ratio is not really what's important. What's important is avoiding the omega-6 fats. And I mean, there are disease models, like age-related macular degeneration, where that's starting to be clearly understood, and you can find papers saying explicitly that the important intervention there that prevents that disease from progressing is reduction of omega-6 fats and you can't prevent it by increasing your omega-3 fats. And I've got papers that show in animal models, very nasty outcomes, liver failure with a lower omega-6 to omega-3 ratio, but high absolute levels of both fats still allows pathology to progress.

Dr. Joseph Mercola:

Once you understand this, it's exactly what you would predict, precisely what you predict.

Tucker Goodrich:

Based on evolution, that's exactly what you would predict. That's right.

Dr. Joseph Mercola:

Yeah. So when you talk about omega-6, it really is synonymous with linoleic acid because that is the bulk of the omega-6. So why don't we diverge out there so people are given a bit of an understanding of the biology of what's going on here. So talk about the omega-6 in general and how linoleic acid is the primary contributor.

Tucker Goodrich:

Sure. So I'm sure most of your listeners are pretty well-informed about this stuff, but there are, broadly speaking, three types of fats, saturated fats, which have a full complement of hydrogen atoms, monounsaturated fats, which are missing a single hydrogen atom, and then the polyunsaturated fats, which are missing multiple hydrogen atoms. What that means is that polyunsaturated fats are very susceptible to oxidation, which means that the fat breaks down into

subcomponents and those are what we're going to spend most of this talk discussing because it's the oxidative breakdown products that have the negative effect on human health.

Tucker Goodrich:

Over the last, call it, 160, 170 years, these have gone from being very rare in the human diet, and you would get them from eating plants and meat and cheese and fish, to being introduced as a product of refined seed oils, like originally cottonseed oil, which was introduced in the late 1800s into the human diet. At one point they had to pass laws because lard was so adulterated with cottonseed oil, because it was a cheap alternative. I mean, not to get too into conspiracy things here, but it was literally a repurposing of an industrial waste product, which is what cottonseed oil was, from the cotton industry into something that they figured out they could detoxify or so they thought and feed it to people which ultimately led to the introduction of Crisco in 1911 as a lard alternative, which really brought consumption of these fats as a, according to Procter & Gamble's marketing department, healthy alternative to animal fats, which seen as being less clean because they didn't come from a laboratory essentially. That's how Procter & Gamble marketed it.

Tucker Goodrich:

So over the next hundred years, consumption of these seed oils went up and up and up, promoted in large part by the cardiology profession, which had convinced itself that saturated animal fats were the cause of the heart disease epidemic that had overwhelmed England and the United States and-

Dr. Joseph Mercola:

That promotion by the cardiologists is really crucial, so there was another initial 50-year period, the first part of the 20th century where medical professionals embraced it largely because of Ancel Keys' work, I believe.

Tucker Goodrich:

Yes, that's true. And a lot of it early on was just that it was a cheaper alternative to butter. I mean, in my economics class in college, they talk about guns versus butter, which came out of the food shortages from World War I. What are you going to focus your production on? Well, the answer to that question, guns versus butter, was seed oils. I mean, that's how margarine was originally invented. It was made from beef fat and refined into something that looked like butter, ultimately they started using vegetable oils, seed oils to produce that same product.

Tucker Goodrich:

And it was always promoted as a healthier alternative to animal fats because there was a widespread – there was a book I can't remember, I think it was "The Jungle," Upton Sinclair wrote a very unpleasant fiction novel about life in the animal butcher industry in Chicago that really turned a lot of people off. There was also a large religious movement through the Seventh-day Adventists who were trying to promote a vegetarian diet as a healthy alternative. So that continued even before that the AMA (American Medical Association) and Ancel Keys came along, there was always that promotion of this as a healthier alternative.

Tucker Goodrich:

So as you pointed out after World War II, it was explicitly promoted as the healthy alternative to animal fats. And the thought was that it would reduce heart disease and we'll get into some of that because they did a lot of human studies at the time and got some rather surprising outcomes, including one that Ancel Keys did.

Dr. Joseph Mercola:

Yeah. So in my mind, this is the most catastrophic, devastating impact on human health in the history of the human race, to make that radical change in the exact opposite direction of what is needed to optimize human health. It has killed millions, probably hundreds of millions of people prematurely and still continues to because people don't understand this.

Tucker Goodrich:

That's right. People don't understand it, especially medical professionals, but a lot of scientists, there's a vast literature that we're going to discuss a tiny little portion of out there. Everything that we're going to discuss today is based on studies that have been done in the medical literature or uncontroversial history of the alteration of the American diet over the last 100, 150 years. So this is the mainstream explanation of what is causing our chronic diseases. What I have done that's distinct is just, I'm an inveterate reader, I'm a speed reader, I love reading medical journals God help me, everybody needs a hobby, this one's turned into mine, but what nobody's really done is gone through and connect all the dots. There are a lot of people who understand little sections of it, but they haven't gone on to coalesce everything into a common explanation for these pathologies across different disease states and different species even. And I think that's what I've been able to do. And I think that's kind of the key insight that makes this message really compelling.

Dr. Joseph Mercola:

It's a radical step in the right direction to help shift the consciousness around this issue because it's so important if we're going to make a massive impact on cutting down the epidemic of this chronic disease. So the brief summary is omega-6, primarily linoleic acid, which I believe is what, 60% to 90% of the omega-6? If you have an omega-6 reading, you're probably somewhere 60% to 80% of that as linoleic acid.

Tucker Goodrich:

That's correct. Yes.

Dr. Joseph Mercola:

Highly susceptible to oxidative damage. You just breathe out the wrong way, it's going to get oxidized. And then these oxidative byproducts are what devastate your health. And we'll go into the specifics of why. But here's the key, 150 years ago, as you alluded to, we had minute amounts and I want to get into some specifics because I think it's important as we tease out the details, it was like 2 to 3 grams a day, 2 to 3 grams a day. And now we're getting 10, 15 and 20 times that. And now that may not sound like a lot because you can eat that much more sugar and still potentially not have problems, though I'm not a big fan and you aren't and most other health care professionals have large amounts of sugar, but compared to this, because sugar doesn't

oxidize like these fats do, it has other metabolic consequences, but it is nowhere near as damaging as these fats.

Tucker Goodrich:

Right, and my personal experience, I mean, there's no question that sugar's not good for you.

Dr. Joseph Mercola:

No, excess sugar, excess sugar.

Tucker Goodrich:

Excess sugar. Exactly. And I have the dental work to prove it. I mean, as I like to say to people who claim that carbohydrates are healthy even in excess, I say, "Look, any food that rots your face isn't healthy." But that said, even avoiding sugar diligently for a couple of decades didn't prevent me from getting sick, didn't prevent the weight gain and it didn't prevent some of the other negative effects that I saw that reversed when I fixed my diet.

Tucker Goodrich:

So there's a wonderful paper out there by a researcher at the National Institutes of Health, Dr. Christopher Ramsden, who looked at the change in the human diet over the 20th century and the single biggest change was the introduction and increase of soybean oil, which is primarily an N6 fat. And it went up a thousandfold over the course of the century.

Dr. Joseph Mercola:

I think it was 10,000. I think it was 10,000fold I'm not mistaken.

Tucker Goodrich:

No, it was a thousandfold, which is still a huge change. It's the single biggest change that happened over the 20th century. And the initial level, I think he said, was like 1% to 3% of energy in the human diet and now it's up to 15 to 20% of energy in the human diet. It's been a massive change and a massive change that was never properly understood prior to its introduction. It's not obviously acutely toxic, right? It's not like you're going to go drink a bottle of corn oil and keel over dead.

Tucker Goodrich:

The parallel I like to make is with cigarettes, cigarettes will make you nauseous and ill the first time you smoke them, but they won't give you lung cancer, that takes time and a constant exposure to it. And I think that's pretty much the best metaphor for excess consumption of seed oils is that it takes exposure over time. It's not going to happen.

Tucker Goodrich:

Now, this gets into the problem with medical research is that it's generally done in short-term. And a lot of the medical research that we count on now, like the food-related epidemiology, which was the field largely invented by Ancel Keys, didn't exist when all of these things were introduced in the diet. So it was a complete blind spot that happened. And then when

organizations like the FDA (Food and Drug Administration) came around, this was something that was generally regarded as safe. And so a lot of research was never done. And I mean, there was no malign intent here, they thought that they were doing something that was good, just like doctors used to recommend smoking because they thought it was healthy. I think there's an excellent parallel there. And only as the diseases that are related to it became pandemic do we start to realize, "Oops, this may have been a mistake."

Dr. Joseph Mercola:

Yes it is. So let's help people understand what this excess consumption does and how it damages your body at a molecular level because you've quoted some of the associations that are present. And I think both of our minds, we view it as probably the single largest variable to this epidemic of disease that we're having. But at a molecular level, it not only damages your metabolism, but your body's ability to generate energy in your mitochondria. And to help understand that, maybe we're diving in prematurely and if there's another topic you want to preface before, that's fine, but in my mind it's probably one of the key elements, there's a very special fat that's primarily only located in your mitochondria and most of it's in the inner mitochondrial membrane called cardiolipin, that has four fatty acids, unlike triglycerides which have three and most of it's linoleic acid, which is-

Tucker Goodrich:

Well, let's clarify that because that's a common misunderstanding in the scientific literature and you'll find a lot of papers that say exactly that. I know we shared one back and forth that said precisely that, that is actually not the case. There were a wide variety of different, what are known as, species of cardiolipin, which means it is comprised of various different fatty acids. Linoleic acid-

Dr. Joseph Mercola:

There's still four, there's still four.

Tucker Goodrich:

There's always four fats, but the individual fats can vary. So some cardiolipin can contain oleic linoleic or palmitic acid or the acids that we get through fish oils, DHA (docosahexaenoic acid) and EPA, I think EPA (eicosapentaenoic acid). Anyway, it can be a wide variety of different fats.

Dr. Joseph Mercola:

Definitely EPA, for sure.

Tucker Goodrich:

Right, and they have very different effects on mitochondrial function, which is an area that's not really well understood, but we see it for instance in the difference between mitochondria in the brain and mitochondria in the heart. The heart seems to really like linoleic acid and preferentially builds cardiolipin with linoleic acid. The brain really dislikes linoleic acid and preferentially builds mitochondria or cardiolipin in the mitochondria with other fats like DHA, which is one of the reasons – to give you an idea of how important this is, 20% of the fat in your entire body is contained in cardiolipin. So this a-

Dr. Joseph Mercola:

Wow, I had no idea. That's a fantastic number. I've never heard or read that before, 20%?

Tucker Goodrich:

Twenty percent is what I think the paper that you sent me said that.

Dr. Joseph Mercola:

I somehow missed it in the paper.

Tucker Goodrich:

Well, it was a very dense paper. I'd read it before you sent it to me. So just for anybody who doesn't understand mitochondria, mitochondria are what distinguish us from bacteria, right? It's what allows us to be a multi-cellular creature. They are what produce the energy in your body, what's known as ATP (adenosine triphosphate), which is a chemical carrier of energy. To give you an example of how important it is, cyanide, which we all know is highly toxic, cyanide breaks your mitochondria, and that's why it kills you so fast. It prevents mitochondrial respiration and therefore your entire body shuts down almost instantly. So this is something we want to take good care of because they're everywhere, in almost every tissue I think, except for red blood cells perhaps, in your body has mitochondria in it. It depends on thousands of mitochondria and things like muscle cells have huge numbers of mitochondria to generate the energy that allows us to walk around and live and breathe into everything else that we do. So, clearly, breaking news is a major problem

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Tucker Goodrich:

There are studies that show that cardiolipin is directly controlled by dietary intake of fats. That is, to an extent, true. Obviously, as I said, different tissues build cardiolipin in the mitochondria out of different fats. But they can vary that composition in fairly short order through changing the diet in rat models, like in the order of weeks. So you can see changes pretty quickly. I notice things happening in days. And some of the things took longer, but you can have an immediate effect on your health in my experience and that of others at this point.

Tucker Goodrich:

What's unique about linoleic acid and cardiolipin is that it is very susceptible to oxidation when it is in the cardiolipin molecule. Two linoleic acids that are adjacent to each other, and as you mentioned, that's what you find in the heart, can oxidize each other. They're also attached to proteins in the mitochondria that contain iron and that iron can catalyze the oxidation of cardiolipin. This is a pretty fundamental process in the body. Lots of us have heard of autophagy. I'm sure you've talked about that.

Tucker Goodrich:

Oxidation of cardiolipin is one of the things that controls autophagy. So it's one of the signals that your body uses to say, "Uh-oh, something's wrong with this cell. It needs to be torn down

and rebuilt," which is basically what autophagy is. It's a mechanism of cleaning up broken cells. And the cell knows that it's broken when it has too many broken mitochondria and the process that controls that is largely the oxidation of omega-6 fats. So by altering the composition of cardiolipin in your mitochondria to one that's richer in omega-6 fats, you make it far more susceptible to oxidative damage. And there are neat studies where they've actually gone and replaced the linoleic acid in cardiolipin molecules with oleic acid, the fat that is in olive oil, and they find that it makes the cardiolipin molecules extremely resistant to oxidative damage. And that is basically what I think we need to go back to. That's the model that we evolved with, is low levels of linoleic acid in our diet and therefore in our cardiolipin.

Tucker Goodrich:

Now, one of the neatest papers I've ever seen looking at this, something that encapsulated this whole model that I'm talking about, took rats, and obviously there are problems with rat models, I'm sure you've talked about that a lot. But this is a pretty good model. They took rats and they fed them either a regular rat chow high-carbohydrate diet, or they added polyunsaturated N6 fats to their diet. Just adding the omega-6 fats to the diet caused the mice to become diabetic. They became insulin-resistant, leptin-resistant and obese, and the differences are pretty stark between the fat mice and the skinny mice on the high-carbohydrate rat diet.

Tucker Goodrich:

But rat diabetes is different from human diabetes. Rats don't get high blood sugar when they get diabetic. So they gave half the rats a poison to make them diabetic. Basically makes them Type 1 diabetic by killing the beta cells in the pancreas. So they killed half their beta cells. All of a sudden they became hypoglycemic. Now, just the high-PUFA diet caused a breakdown in the cardiolipin content in the mitochondria in their hearts. So just adding seed oils caused heart damage through a change in the cardiolipin composition. Adding hyperglycemia on top of that caused necrosis of the heart. They induced heart failure in these rats. Heart failure, as I'm sure Dr. Mercola will comment, is one of the biggest health crises that's going on in the industrial world and is going up every year. And we now have an animal model of how to induce heart failure in a very short period of time, which is, "Feed him omega-6 fats and make him hyperglycemic" and boom, you get it almost instantly.

Tucker Goodrich:

Now in people it takes a lot longer, but this is one of the cleanest models I've seen of how to induce an epidemic disease that there's not much other explanation for why it's happening in humans.

Dr. Joseph Mercola:

I think this would be a good time to tangent, is explain what they actually find. Because the seed oils, as you mentioned, caused it, but the seed oil by itself isn't the issue. It's the oxidized byproduct.

Tucker Goodrich:

That's exactly right.

Dr. Joseph Mercola:

One of the ones we're most commonly familiar with is 4HNE, and there are others, but this is the one that's relatively easy to measure. And I think in this study you quoted, that is what they measured. There's just a complete, absolute correlation between the elevated levels of 4HNE and the heart failure.

Tucker Goodrich:

Sadly, in that particular study, they didn't measure 4HNE.

Dr. Joseph Mercola:

Okay. I confused it with another one then.

Tucker Goodrich:

Yeah, there are other ones. There are studies looking at HNE in humans. Now, HNE is the primary breakdown product of linoleic acid after it gets oxidized. Why is this important? It's highly toxic. Linoleic acid breaks down to HNE, even just in storage. This is well-demonstrated in literature. If you add heat, it breaks down even faster. One of the amusing things about the cardiology profession and polyunsaturated fatty acids is on the one hand, they tell you to eat lots of them because they're "heart healthy." On the other hand, they tell you, "Don't eat fried foods." Well, what are foods fried in? They're overwhelmingly fried in vegetable fats nowadays.

Tucker Goodrich:

And the problem with that, and the reason that cardiologists after telling you to eat them tell you not to eat them is because these fats break down into HNE when they're cooked. Again, this is one of these things where the best source for reading about that is to go read the industrial literature from the oil industry, where you find papers looking at what happens to French fries when they're fried in vegetable oils and how they become full of this toxic product. And the industry is saying, "Maybe this is a problem, guys. We shouldn't be eating this stuff."

Dr. Joseph Mercola:

It's an interesting tangent, that there's an organization extensively designed or whose purpose is to protect the public health. It's called CSPI, Consumers for Science in the Public Interest. And they took out full page ads in the '80s, I think, encouraging McDonald's to stop cooking their French fries in beef tallow, which is primarily a saturated fat and switch to vegetable oils. They are probably responsible for killing prematurely tens of millions of people.

Tucker Goodrich:

I don't think that's a huge overstatement. And I mean, even now you can go find papers and literature. Let's just go through three of them really quickly, which will kind of lead us into the, what diseases are we talking about here. But they're in cancer, in fatty liver disease, in two different cancer models, in fatty liver disease, and, oh, I'm missing one right now, but we'll just talk about those too. You can't induce those diseases without linoleic acid in the animal models that they use in laboratories. So if you feed a rat beef tallow, you can give it 30% of its calories

as alcohol, and it won't get alcoholic liver disease. You must give them seed oils to induce cancer in animal models of cancer. You must. It is required. That's the language used in the paper.

Tucker Goodrich:

So this is a really fundamental process that we're talking about here. And this is in the animal cancer models from 0% up to 4% or 10%, depending on which model you're looking at of energy as seed oils increases cancer incidents up until you get to a threshold. So in the breast cancer model, cancer incidents increases up to 4% of calories as seed oils, and then additional seed oils doesn't cause any more cancer. Now, what's the relevance to us? Most people in the United States are at 8%. So we're way over what these thresholds in the lab would suggest is a safe level of these fats based on the laboratory work in animals.

Tucker Goodrich:

Which, it's important to note, is how toxicology is done. We don't give things that are suspected to be toxic to people first, generally, outside of the food system, of course. We give it to animals. And then, I can't think of any product that if you gave it to animals, increased their rate of cancer, gave them fatty liver disease and caused obesity, would make it into the food supply. But that's where we are right now. We've got this huge disconnect between what the lab science tells us we should be doing with this and what our dietary guidelines tell us we should be doing. The scientists are saying, "Oh, look, it's poison. It causes all the chronic diseases." And the government's saying, "Eat it. Eat lots of it." That's not a good thing.

Tucker Goodrich:

So, cancer, HNE is a mutagen. A mutagen is a toxin that causes DNA damage. One of the primary genes that HNE damages is the P53 anti-cancer gene. This is the most common mutation in cancers. It's found in 15% of cancers. It's preferentially mutated by HNA, which can explain a lot of the increase in cancer over the last 120 odd years. P53 is literally a cancer prevention gene. It's how your body regulates cancer. You can all draw your own conclusions about the wisdom of eating something that can cause that to break.

Tucker Goodrich:

It has been demonstrated. I've got a long post that I'm going through right now. It has been demonstrated in the animal models as the cause of obesity. There's an animal model of obesity, a lab diet called D12492, which was named the Cookie Dough Diet by Stephan Guyenet. Rats love to eat it. It's like eating cookie dough. It makes them obese. It gives them diabetes. This is the standard diet that's used by scientists to make rats sick like humans get sick.

Tucker Goodrich:

And that's an important point that I just want to make is a lot of these studies that I'm talking about are going to be fairly recent. And that's why a lot of this is new information to people because a lot of this work has come out recently. So in this 2012 study, Ramsden, the scientist who I mentioned before, who looked at the increase in soybean, looked at a mouse model of the increase in linoleic acid in the diet over the 20th century and found out that that is exactly what causes obesity in this mouse model. If you feed the mice lots of saturated fat, they don't get fat

and they don't get sick. It's only when you increase the linoleic acid in the diet from 1% to 8% that they become obese.

Tucker Goodrich:

Now this standard mouse model of fat to induce obesity typically has like 20% of the energy in the diet is N6 seed oils. Other people have come along and confirmed that finding and they've looked at – now what's really interesting, again, how do we take this from animals to people? Because people aren't mice and rats in labs. What [Anita R.] Alvheim [inaudible 00:44:26] and Ramsden were observing is that back in 2006, I think, there was a drug introduced called Rimonabant, which was an anti-obesity drug. It was a bit of a “miracle drug.” I want to quote this exactly because it's so important to understand the effects that this drug had on humans. "Large randomized trials with Rimonabant have demonstrated efficacy in treatment of overweight and obese individuals with weight loss significantly greater than a reduced-calorie diet alone. In addition, multiple other cardio-metabolic parameters were improved in the treatment groups, including increased levels of HDL, reduced triglycerides, reduced weight circumference, improved insulin sensitivity, decreased insulin levels, and in diabetic patients, improvements in HBA1C." This paper was released in 2007. Unfortunately, Rimonabant had a side effect that it caused people to want to kill themselves. So it was withdrawn from the market and it largely killed research for several years into that area.

Tucker Goodrich:

But what Alvheim [inaudible 00:45:38] did in 2012 was demonstrate that the mechanism behind Rimonabant is to block the metabolism of seed oils into the chemicals in your body and the endocannabinoid system that cause overeating. Now, I had mentioned my experience when I stopped eating seed oils was that I forgot to eat carbohydrates. The effect of Rimonabant in these mouse models is to make them crave carbohydrates and to stimulate them to eat sweet foods and carbohydrates. And everybody's familiar with this effect. Well, not everybody's familiar with this effect in humans, but everybody's heard of this effect in humans. It's called the munchies. And it's what you get after you smoke pot. Because the endocannabinoid system is the system that marijuana affects and the chemical that Rimonabant blocks is your body's homologue to the THC (tetrahydrocannabinol) in marijuana.

Tucker Goodrich:

So essentially what we've done to ourselves is given ourselves a chronic case of the munchies, which is blocked by this, unfortunately, very harmful drug to people. This is as open and closed a case for causation as you're going to find in the medical literature. We have a human drug that treats this, and as I just read, it treats all these different aspects of this disease. And it works through this one pathway that we have a clear demonstration of in animal models.

Dr. Joseph Mercola:

Yeah. And that would be great if we could use a drug, but I learned many decades, I appreciated the fact that drugs rarely, if ever, if ever are the solution for disease. And even when they effectively treat the mechanism, they almost invariably have some side effect that in many, if not most cases, is far worse than the disease they're designed to treat. In this case suicide. So if you're not [crosstalk 00:16:35]. Yeah.

Tucker Goodrich:

And in this case, the drug is completely pointless because the dietary fix is well-known and is simple.

Dr. Joseph Mercola:

Absolutely, 100%. I just want to take this back and kind of tie it in for people so they get it. Because I don't want to go down the rabbit hole on some of these studies deeply, but they're supportive of this main thesis, which is to understand that a mere 150 years ago, one century and a half, the average dietary intake of this linoleic acid was about 2 to 3 grams a day. Around that same time, the diseases that we're talking about, cancer, heart disease-

Tucker Goodrich:

Diabetes.

Dr. Joseph Mercola:

No, of the two primary ones that kill more than 50% of the people. Then of course, there's diabetes, obesity, dementia and age-related macular degeneration, all of these diseases and correct me if I'm wrong, but I believe they were at that time, 1850, were less than 1%. In some cases it was a very rare disease, virtually undocumented, like some of these cancers and age-related macular degeneration, they didn't exist almost.

Tucker Goodrich:

That's exactly right. That's what we saw over the 20th century was a huge increase in all of the chronic diseases.

Dr. Joseph Mercola:

We're tying it together. It's this increase in linoleic acid and ultimately it's oxidative end products which cause the damage, but it's the increase. Simply lowering it down to the way our great, great grandparents had and used, you can essentially eliminate almost every single one of the diseases that is prematurely killing us.

Tucker Goodrich:

That's what we're hoping. Probably the most radical change that I personally saw, and it's another one that once this happens to you and you turn around and you start looking into the scientific literature, you find out that this is a well-documented effect. And it's one of the reasons why I stopped seed oils in the first place. Because I read a blog post that Stephan Guyenet did that detailed how seed oils control sunburn. And that sounds nuts. I'll be the first one to say that. It sounded really nuts to me because, I don't know if all of your listeners are going to be able to see me, but I'm blonde, blue-eyed, pale-skinned guy who used to be super susceptible to sunburn. I would go out and turn into a roasted tomato in 45 minutes. It was horrible. I hated the sun. I had to wear sunglasses all the time, hats. But I ski and I love the outdoors. So I was always out into the sun.

Tucker Goodrich:

So shortly after I fixed my diet, in the order of weeks, I went skiing in March on what we call a bluebird day, not a cloud in the sky. And the end of the day I came in and typically I would have a sunburn on my face and I had nothing. And I was just like, "Ooh, this is, you know-" I'd heard an anecdote about a guy who said that changing his diet cured his sunburn tendency. And I thought that was ridiculous.

Tucker Goodrich:

So then a couple of weeks later, my now ex-wife and I went to an event in New York City in Central Park. And we stood out in the sun side by side for two and a half hours. I generally don't use sunscreen unless it's really extreme because I hate sunscreen. But anyway, we both stood there side-by-side, we got home at the end of the day, and she looked at me and she said, "Look how burned I got." And I looked at her and I said, "Look at me. I didn't burn at all." Now this is really notable because I'm pale and blonde. My ex-wife was dark and Colombian, dark-skinned and she burned and I didn't.

Tucker Goodrich:

Since then, it's been almost 10 years now, and I've been up to the Alps at altitude and I moved down to Texas and lived there for a year where I would go out and run, I love to run so I would go out and run for three or four hours and go out on my mountain bike. I get a little pink at the beginning of the season and then I go the entire rest of the summer with no sunburn and no sunscreen. And thanks to the miracle of Twitter, I have countless anecdotes from other people who've seen the exact same thing.

Tucker Goodrich:

So go to the scientific literature and what does it say? It says susceptibility to UV (ultraviolet) radiation damage is controlled by how much polyunsaturated fats are in your diet. It's like a dial. They can control how fast it happens and how fast you get skin cancer by how much omega-6 polyunsaturated fat they give these mice. "Gee, that's kind of a good thing to know. Don't you think?" If you look at the charts, the epidemiology of sunburn, it's skyrocketed over the last few decades, right? And it's skyrocketed in concert with this steep increase in the use of sunscreen-

Dr. Joseph Mercola:

Seed oils.

Tucker Goodrich:

Which obviously isn't doing anything because skin cancer incidents, including nasty ones like melanoma, which have also been epidemiologically linked with seed oil consumption. This is a kind of useful thing to know. It just changed my life not having to worry about sunburn anymore. And this is 10 years into it at this point. It's fantastic.

Tucker Goodrich:

It doesn't mean that I'm invincible, by the way. I mean, if I'm out in the sun for seven or eight hours, I'm going to get a bit of a burn because look at me.

Dr. Joseph Mercola:

Yeah, or to go to the tropics.

Tucker Goodrich:

Yeah. If I go to the tropics or I go up at altitude, then I'll use some sunscreen on my face or wear a hat or whatever, do something sensible about it. But the difference between the 45 minutes it used to be and six or seven hours, that's a huge change in lifestyle for me and I think for anybody else.

Dr. Joseph Mercola:

Yeah. We have and still do promote and there's probably other benefits for it too, an antioxidant called astaxanthin, which consistently increases the time at which you will sunburn. The mechanism is protecting linoleic acid degradation most likely.

Tucker Goodrich:

Bingo. That's exactly right. That's exactly right. And we can't get out of this without discussing carnosine and rosemary at some point just as [crosstalk 00:54:15].

Dr. Joseph Mercola:

-what's down the road. But I want to go to another analogy that – the sunburn was a beautiful metaphor and illustration as to what's going on here. But I want to take it to an even more contemporary challenge, which is 2020 and the introduction of SARS-CoV-2 and the COVID-19 pandemic. So with all this knowledge and influence that we have of how it connects to chronic disease, how about acute diseases like dying from SARS-CoV-2?

Dr. Joseph Mercola:

So, you've written about and in previous podcasts discussed this and I'd like you to review that now, especially for some of these metabolic byproducts and white blood cells, like leukotoxin that take this linoleic acid and just convert it to this toxic structure. And I've done and read a lot about COVID-19 and the metabolism and the physiology of what's going on and vitamin D and some of the other cytokine storms and all of the inflammatory components. But this was the first time I've ever really understood it at an even deeper level, the fatty acid substrates to contribute to this inflammatory domino effect. So why don't you review that with us? Because it really is fascinating. So if you integrate this knowledge, you'll radically lower your risk for developing a complication from exposure to this virus.

Tucker Goodrich:

Yes. That's certainly what the conclusion that I drew from it. I did an enormous post on this, looking at what are the effects of linoleic acid in SARS CoV-2 and SARS in general. So, SARS is a severe acute respiratory syndrome, right? That's the name given to COVID-19 originally. SARS kills you by giving you what's known as acute respiratory distress syndrome, ARDS. Okay? ARDS can be caused by lots of different things. Not just these viruses. You can get it from influenza. You can get it from inhaling acid into your lungs. There are lots of different ways to give yourself ARDS.

Tucker Goodrich:

What's fascinating is the human literature is quite clear that you can induce ARDS through feeding seed oils. Let me say that again. You can induce ARDS through feeding seed oils. Very sick people who can't eat are fed intravenously. It's called total parenteral nutrition. And generally this is used through a product called Intralipid, which is made out of soybean oil. Soybean oil and sugar. Yes. I know. It's really kind of – when you start to understand all this stuff, it's just mind boggling.

Tucker Goodrich:

So, some doctors did an experiment where they noticed that a lot of their patients who came into the ICU and got TPN then subsequently got ARDS. So they started playing with what they were feeding them. And what they discovered was this soybean oil formula increased the patient's rate of getting ARDS, which, just to back up a small bit, the fatality rate from ARDS is 30% to 60%. So you really don't want to get this even outside of the context of COVID-19. So they discovered that feeding seed oils increased the rate of ARDS by seven times. Sevenfold.

Tucker Goodrich:

Now, to their credit, these doctors did a paper that was kind of bad science because they changed the variable as they saw what they were doing to their patients, but extremely good medicine. Between the beginning and the end of the study, which went on for several years, they stopped using this infusion in their patients to the extent that they could. There are some extreme circumstances where it's unavoidable. And they saw the rate of ARDS go down sevenfold in humans over time in a real hospital environment. So, okay.

Tucker Goodrich:

They've also found that in humans, the amount of N6 fats in your body predisposes you to getting ARDS. So what happens in COVID-19? The body comes into contact with this virus. The virus starts attacking, obviously the cells in your lungs is where it kills you and your body starts an immune reaction. The white blood cells come and they try and take away the cells that are too infected and they produce toxins to try and kill the virus. The key toxin that's produced in ARDS, the one that causes the symptoms that kill you, is a toxin called leukotoxin. Leukotoxin because it's made by leukotrienes, which is one of the names given to white blood cells.

Tucker Goodrich:

So leukotoxin is made from linoleic acid.

Dr. Joseph Mercola:

I think it's leukocytes is what you mean. Not leukotrienes. Leukotrienes is a [crosstalk 00:59:36].

Tucker Goodrich:

Yes, I misspoke. Leukocytes. Yes. Thank you. Leukotoxin is made from linoleic acid by white blood cells to kill pathogens. And it's toxic enough where if you inject it into animals, it kills the animals in minutes, if you inject enough. Highly toxic substance. Leukocytes that are incubated with linoleic acid convert all of the linoleic acid into this toxin until there's none left. So this is a very fundamental disease process, right?

Tucker Goodrich:

One of the other things that happens in ARDS is the omega seed oils, I found a great study that looked at ARDS in patients in sepsis. And what they saw was that over time, the amount of omega-6 fats in tissue declined, but what increased was HNE and probably leukotoxin, the toxic metabolites of these fats. So a major part of the disease process in ARDS is the conversion of omega-6 fats into these toxins. And that is what is killing these patients.

Tucker Goodrich:

It is often noted that what kills people in the popular press, you will hear about this cytokine storm. But what I'm describing is the mechanism of the cytokine storm. Leukotoxin is uniquely what causes the symptoms of ARDS as has been clearly demonstrated in the animal models.

Tucker Goodrich:

So it seems to me, that a sensible thing to do would be look at the research in humans, note that people who have higher levels of omega-6 are more susceptible to get ARDS and change your diet, right? Why wouldn't you want to do that?

Dr. Joseph Mercola:

Absolutely. So, thank you for expanding on that and explaining it. So this is a disease that will kill anywhere from 90% – the likelihood of you getting this disease and surviving is anywhere from 95% to 99.99%. So in other words, you're likely not going to die from this. But what you will much more likely die from is cardiovascular disease, heart disease, heart attacks, heart failure. That's probably a 30%.

PART 2 OF 4 ENDS [01:02:04]

Dr. Joseph Mercola:

So can you similarly review what's going on with high linoleic acid content and how it contributes to the physiology and the anatomical disruption within the intima and the inside of the blood vessels that leads to these plaque formations causing heart disease?

Tucker Goodrich:

Yeah, let's go over that. So there's a great – all of us hear about good cholesterol, bad cholesterol, and LDL, right? Back in the 1980s, there were a pair of doctors who were also scientists, Dr. Brown and Dr. Goldstein, who got a Nobel Prize for discovering the LDL receptor. So the next thing that they decided to do was – and I want to look up this quote here. Unfortunately, I don't have it in front of me. Okay, there we go. I got it.

Tucker Goodrich:

So Brown and Goldstein discovered the LDL receptor. And the next thing that they tried to do, one of the first things that happens in atherosclerosis is your white blood cells, your macrophage, another type of leukocyte, turns into what they call a foam cell. And the thought was that this happened because they take up an excess amount of LDL full of cholesterol and fats, and they become stuffed with it and turn into this foam cell, which is a macrophage often stuffed with fat

and cholesterol. That's what the core of an atherosclerotic plaque is, is basically dead macrophages and other types of cells that are stuffed with cholesterol and fat. That's why they blame it on cholesterol and fat, right? Because that's what you find. And there's certainly a certain logic to that.

Tucker Goodrich:

So Brown and Goldstein took some LDL and they took some macrophages and they put them in a vial together, and they waited for the macrophages to turn into foam cells, but they didn't. It didn't work. The experiment failed. Shortly after they discovered that they had to modify the LDL, and they didn't exactly know what the modification was that was happening in the body. But if you modify the LDL, the macrophages will Hoover it up and turn into foam cells, which is what's happening in the body. But the modification they used wasn't what you see in the body. It was purely a lab-based thing. But what it made perfectly clear was that LDL does not initiate atherosclerosis on its own. That's an important thing to understand.

Tucker Goodrich:

Then two other doctors came along, Dr. Steinberg and Dr. Witztum. Very brilliant guys. They figured out what kind of modification happens to LDL. It turns out – and then they did some animal experiments, and then they did some human experiments to confirm that this was actually the mechanism that happened in people. So what were these experiments that they did? They first took rabbits and then humans, and they fed them either soybean oil or seed oils. And then they measured how fast and how susceptible their LDL was to this modification, which is now called oxidized LDL. And it turns out that olive oil is protective because it doesn't contain linoleic acid. It turns out that what's happening in linoleic acid is almost the exact same-

Dr. Joseph Mercola:

Olive oil has linoleic acid.

Tucker Goodrich:

Very little typically. Well, we'll get into – let's get into olive oil in a minute as an aside because-

Dr. Joseph Mercola:

[crosstalk 01:05:47] because it's an ostensibly healthy fat, but even one that I think many people would benefit from limiting. Severely limiting, maybe restricting completely.

Tucker Goodrich:

I agree with that. We should talk about olive oil separately because olive oil has one unique trait that other fats don't seem to have in regards to coronary disease. So let's come back to the olive oil topic. What they discovered is that this oxidized LDL is what is actually getting Hoovered up by the LDL to form foam cells. And the LDL's susceptibility to this process is controlled by the linoleic acid content of the diet in animals and in humans. And that's a result that's been repeated several times, so subsequently, that literally, the definition of an atherogenic lipid in your blood is one that contains oxidized omega-6 fats. That's it. That's the definition.

Tucker Goodrich:

As I said a while ago, all of what I'm saying here is mainstream medicine, but they just don't understand the consequences of what they're looking at. They're not connecting the dots well enough across these different areas of disease and research. So the standard explanation of why you get heart disease and why it progresses the way it does is because the omega-6 fats in your blood get oxidized and become toxic, and progress you all the way through atherosclerosis until it finally kills you. That's the standard explanation for what causes heart disease. I can't tell you how many cardiologists I have talked to who don't understand that that's what the medical literature says is causing this disease. Now, it's worse if you're on a high-carbohydrate diet. And we can get into that, into why a ketogenic diet is somewhat protective against the negative effects of this. But I can't stress enough that this is the standard explanation for cardiovascular disease in the medical literature. That seed oils oxidize and that's what causes the pathology.

Tucker Goodrich:

Now, unfortunately, after doing this research, Daniel Steinberg convinced Merck to bring a drug to market called a statin, which some of you may have heard of. And statins were found to reduce LDL. And the hypothesis was that that would reduce your susceptibility to cardiovascular disease, which they do to some small extent. But all of a sudden, you're doing what we talked about prior. You're fixing the cause of the problem with taking a drug, to put a Band-Aid on the problem. I don't think that's a good approach. It's not the approach I'm comfortable taking myself.

Dr. Joseph Mercola:

A drug in this case, which has severe metabolic mitochondrial implications.

Tucker Goodrich:

Yeah, statins are a mitochondrial toxin. We talked earlier about how important your mitochondria on. I would definitely want to avoid taking a mitochondrial toxin.

Dr. Joseph Mercola:

Now, you can compensate for it by taking CoQ10, but still, you're not treating the cause. You've got to treat the cause if you want to get successful.

Tucker Goodrich:

Exactly. And that's the engineering approach to things. You don't keep putting Band-Aids on things. At some point, you have to just stop and say, "Okay, we went down the wrong path, and back it out." In my experience with junior developers, this was the hardest thing to get them to do. They would come up with some neat new idea and they would keep poking at it, trying to fix it. When sometimes the thing to do is just to walk back, walk it back, go back to what you had before, and try and come up with a new approach to it.

Tucker Goodrich:

Cardiovascular disease has gone down a lot since the middle of the 20th century, but it hasn't been because of statins. I'm sure you know that it's because of smoking, because it started well before statins were introduced. But statins is a side topic. Let's not go down that road. But people are curious, why did these guys abandon this line of research? It's because they decided that

applying this Band-Aid of statins was the way to treat the problem. Research, of course, has continued. And you can find countless papers talking about the oxidative stress model of cardiovascular disease. And as far as I'm aware, all the mechanisms of why it progresses center around the oxidation of omega-6 fats. And there are lots of other players in that. Smoking, for instance. Why is smoking so bad for you? Because it kicks off the oxidation of omega-6 fats in your body through these highly toxic chemicals.

Tucker Goodrich:

Acrolein. Okay, quick little tangent here. Acrolein is thought to be the chemical in cigarette smoke – that's a great Wikipedia article to read about, acrolein. Biocide is what they call it, meaning it is so toxic it kills anything it comes in contact with. This is why you shouldn't smoke, because you are sucking a biocide into your lungs. What's another way to make acrolein? Well, you can take physiological levels of glucose and linoleic acid and mix them in water, and they will generate acrolein on their own. Just let them sit there and they will generate toxins. And that seems to be exactly, as that rodent model I talked about before where they induced heart disease in a couple of days, that's exactly what they did. They gave them PUFA and hyperglycemia and boom, they got heart failure in a couple of days.

Dr. Joseph Mercola:

Or you could heat vegetable oil and get high levels, so much so that an order of French fries would be equal to several packs of smoking cigarettes with respect to their acrolein concentration.

Tucker Goodrich:

Brilliant point. Brilliant point. So it turns out in China, they have a big problem with lung cancer in women who don't smoke. It's a big problem over there. Turns out it's caused by cooking with seed oils. It's a carcinogen. So oops, that's a problem. It took them a while to figure this out. But if you cook – they fry with seed oils in, say, a wok, and they are breathing in the fumes. And if you don't have enough adequate ventilation, it gives you lung cancer. It's odd they don't put a warning on the Wesson corn oil that you can go buy at the supermarket. Known carcinogen in humans. Please don't cook with this.

Dr. Joseph Mercola:

Well, yeah. Maybe let's tangent back to the olive oil discussion because I think it's an important one. And I think I actually read on your blog in the discussion, it wasn't in your article, it was in the comments section, where you replied to someone essentially explaining how to fractionally distill the olive oil and separate the dangerous linoleic acid and remove it from that for essentially just an investment of time. There are no other costs involved.

Tucker Goodrich:

Okay. Yes, let's talk about olive oil, because it's interesting to understand olive oil in terms of the whole disease process.

Dr. Joseph Mercola:

It's an important one. This is definitely an important one.

Tucker Goodrich:

Yeah. The main fat in olive oil is oleic acid. Oleic acid is your body's favorite fat. Your body makes hoards of oleic acid every day, which is why it's not considered an essential fat. That's another thing we should touch upon. Oleic acid is much more resistant to oxidation than linoleic acid is, which is why olive oil's pretty decent cooking oil.

Tucker Goodrich:

In two different disease models that we've looked at so far, cardiolipin oxidation and LDL oxidation, oleic acid is protective, because again, it's only one double bond, so it's much less susceptible to oxidative damage. So that's all good things. What's really interesting is that in some of these studies that looked at oxidative damage in LDL, oleic acid has the property of being able to replace linoleic acid in LDL. Other fats like palmitic acid is what they used in one study, palm oil, does not do that. So it's, I think, important to have sources of oleic acid in your diet.

Tucker Goodrich:

The problem with olive oil is that, as Dr. Mercola noted, it does have a fair amount of linoleic acid. The percentages that I've seen quoted in literature range from 2%, which is awesome, to 22%, which is not good. The other problem is the olive oil market is hugely corrupt. And what they often do is they cut olive oil with cheaper seed oils, like soybean oil, and then add-

Dr. Joseph Mercola:

[inaudible 01:15:10].

Tucker Goodrich:

Yeah, they add other chemicals to make it look and smell like olive oil and then they sell it. It's fraud. It's food adulteration. But 80% to 90% of the olive oil market is adulterated with seed oils. So you can get better olive oils. Mostly what I do is just buy California olive oils, which typically come out as the top-rated in terms of not being adulterated. But you can't really tell how much linoleic acid it has. So I use it, but I use a little bit of it, not a lot. Not for cooking, just for some salad dressings that I like to make.

Tucker Goodrich:

Now, the fractionation tests that you were talking about is something that I thought worked for years, which is that you put your olive oil in the fridge and if it solidifies, that means it's a good fat. The problem is I read the research, and it turns out that neither the healthy or the unhealthy fat solidifies in the fridge. So what that test tells you is how much saturated fat your olive oil contains, which can be quite a lot. I've had jars of olive oil that turned pretty much solid in the fridge, and some other ones that were what I thought good brands that didn't solidify at all in the fridge. So it's unfortunately not – that's why I avoid olive oil generally, because you really can't tell what the unhealthy fat content is.

Dr. Joseph Mercola:

So you're saying the refrigerator trick that you discussed in one of your comments doesn't work?

Tucker Goodrich:

Doesn't work.

Dr. Joseph Mercola:

Oh, darn.

Tucker Goodrich:

Sorry.

Dr. Joseph Mercola:

Okay.

Tucker Goodrich:

I did that myself for years. And then I think it was the Olive Oil Council of California went and actually did some research. They hired a guy to actually do the research and it doesn't work. Bummer. But that's science.

Dr. Joseph Mercola:

So normally – I guess there's so many different roads that we can go down, but I guess it might be wise here to discuss the stress – now that you have a foundational grounding of some of the reasons why you want to seriously consider avoiding or limiting, severely restricting linoleic acid, let's talk about the numbers. Because I think this is the key. And I believe I have a strategy that will be very effective, but I wanted to run it by you. So it's a pretty simple strategy. Replicate what our ancestors did. Approach the historical standards of a mere 150 years ago, which is 2 to 3 grams per day. And I guess that the concern is obviously you could probably go above that without too much harm, but what's the threshold? Is it 5 grams? Is it 10? I think anything over 10 has got to be too much. But I'm wondering what your conclusion after you reviewed the extensive literature as to what threshold should we limit our linoleic acid to? How many grams per day?

Tucker Goodrich:

We don't know.

Dr. Joseph Mercola:

Okay. Well, I know [[crosstalk 00:18:14](#)].

Tucker Goodrich:

But let me talk about that real quick, because that's a key point. So there's a tribe of Indians in the Amazon jungle in Bolivia, I think, called the Tsimané. And the Tsimané are the poster children for the cardiologists of late because they don't get heart disease. That's really cool. And they're not unique. Americans didn't get heart disease 150 years ago. The British didn't get heart disease 150 years ago. But these people still don't get heart disease. So they've been down there for a number of years studying them. And they noticed that as they were getting more exposure to what they call “market foods,” they started getting obese. Oops. So they did a neat paper. Okay,

so what do we take away from that? If you don't want to get heart disease, eat like the Tsimané. That's a pretty cool thing. They have other health issues, like they don't often get enough food to eat. But that's awesome.

Tucker Goodrich:

So then they noticed that they were starting to get fat. So they did a study on why were they starting to get fat? And it was because, I read one, I think it was a magazine article. It was hilarious. They said that obesity in the Tsimané was associated with motorboat ownership. What? Motorboat ownership? That's bizarre. But they live out in the middle of the jungle. The only way they can get to the food store to buy market food is on a motorboat. What are they buying? They're buying cooking oil. So we have this paper in the Tsimané that says, "Oh, look, obesity in this healthy tribe is correlated with the recent increase in cooking oil in their diet."

Tucker Goodrich:

So let's look at what they ate. The ancestral model that you're talking about, what used to be called the paleo model, which I think is absolutely the right thing to do. Without question. They were eating as much animal meat and fat as they could get. We talked about oleic acid, how it's a healthy acid. It's your body's favorite fat. Most animal fats, I think beef tallow is 46% oleic acid, lard is 36% oleic acid. Depending on the lard that you get, lard basically has the same fatty acid profile as olive oil does. So it's the other healthy fat, although we'll talk about the linoleic acid content of that as well.

Tucker Goodrich:

So what should you be eating? What are the Tsimané eating? Well, they eat a fair amount of carbohydrates because they're very poor people. They live in the jungle and they grow yams and things like that and bananas. They eat as much animal protein and fat as they can get their hands on, and their biggest complaint in life is that they can't eat as much meat as they want. And they eat lots of vegetables. And they don't eat any seed oils up until recently, which is why they're starting to get sick.

Tucker Goodrich:

So what I tell people is it's what you avoid that makes – the difference between the paleo diet, lots of anthropologists criticize the whole ancestral health concept because they say we don't know what these people ate, and they ate all sorts of different things because they lived all over the world. And that's absolutely right. But the point is we do know exactly what they weren't eating. All of them weren't eating industrial seed oils because they didn't exist up until recently. They weren't eating super high amounts of carbohydrates with some exceptions, and you can track those exceptions through their dental health in the literature. So they weren't eating lots of refined foods. So the caveat here is that what you eat is not just what you ate, but it's also what your food ate.

Dr. Joseph Mercola:

Now, I want to get to-

Tucker Goodrich:

So this is a key point. I presume most of us remember DDT, the anti-mosquito toxin that was banned back, I guess, in the '70s. The problem with DDT was that DDT concentrated up the food chain. So a mosquito would eat a tiny little bit of it and sick and get eaten by a frog, and so on and so on and so on, until you got to a bald eagle who got this huge bolus of DDT from the foods that it was eating and it died, or its eggs would break. So they banned DDT. Seed oils do the exact same thing.

Tucker Goodrich:

So there's the pair that I mentioned before, Alvheim and Ramsden, along with some other co-authors, did a really interesting study where they took salmon, farmed salmon from Norway, where Alvheim was from, and they fed it soybean oil, which is what they feed farmed salmon, is soy meal. So they fed the salmon and they looked at what happened to it, and it got the typical things that you would expect. It got obese, basically. But then they took the salmon and they fed it to mice, and the mice got obese too. So it bio-accumulated into the mice, concentrated up the food chain. What do we feed our animals? We feed them as much grains as we can. That's what pigs and chickens are fed. Cattle we only feed them a little bit at the end of their lives. Cattle are ruminants, so they're somewhat protected against this.

Tucker Goodrich:

But back to the Cookie Dough Diet, D12492, the manufacturer of that had been telling everybody that the fatty acid composition was, boy, I think it was 9% or 10% linoleic acid. And they were basing this off the USDA (U.S. Department of Agriculture) food database, the thing that we all look at if we want to figure out how much of different nutrients are in a food. That's all aggregated by the USDA. So they got curious, and they went and they actually tested the lard that they were using in this diet. The fats used in this diet are lard and soybean oil. And what they discovered was that the percentage of N6 fats in the lard they were using was twice what the USDA said it had been because the food the pigs are eating has changed over the years, and they're accumulating a lot more N6. Same thing with chickens. And since we know it bio-accumulates, you also need to avoid what I call industrially farmed animals.

Tucker Goodrich:

Now, cows have a rumen, and the bacteria in the rumen protects you from this. Cows also gets sick from too much green in their diet, but they get sick in a different way. They don't bio-accumulate these fats to the same level. The same is true for other ruminants like goats or lamb. So you've got to not only – and the same is true for chicken eggs, which is why you want to try and get omega-3 chicken eggs, which are fed with flax instead of less healthy grains. Or ideally, pastured chicken eggs, which is probably the best option for chicken eggs.

Dr. Joseph Mercola:

So let me dive down a rabbit hole of the chickens, because I've got seven to 10, maybe 12, depending on the time of the year. And how vicious the predators are attacking my chickens and I'm unable to protect them. But anyway, chickens are the largest source of linoleic acid in my diet. I noticed this when I became aware of linoleic acid and the implications on health. And then I realized that even though I've got 2 acres for my chickens to run around on, they're clearly pastured. I feed them reverse osmosis clean water, and they only get organic grains. But I didn't

think that was an issue because I thought that was the state-of-the-art and that's what chickens were designed to eat.

Dr. Joseph Mercola:

And then I realized, I look at the bag of the grains that they're eating, it's soy and corn primarily. So I said, "This isn't going to work." So I stopped it. They are not eating any of that anymore. And the only thing I feed them is mung beans, which I sprout. I give them a cup of mung beans that sprouts over four days, so it's half a gallon. Probably going to up it to a gallon a day because I think they need more carbs. And then I give them mealworms. And I was surprised, though. Mealworms have about 20% to 30% of the fatty acids are linoleic acid.

Tucker Goodrich:

Well, again, it's what are the mealworms being fed?

Dr. Joseph Mercola:

Yeah, I know. That's the thing. I think, so actually, my experiment is probably going to be extended. And I'm going to probably raise my own mealworms, which is a lot of extra work.

Tucker Goodrich:

My apologies for all of this.

Dr. Joseph Mercola:

But anyway, I'm going to do the due diligence. I've already identified the lab. I'm going to do the fatty acid analysis on the eggs pre and post and see what the difference is. But it's-

Tucker Goodrich:

Yeah, and offline, I'll tell you how the farms that I used to buy eggs from raise their chickens to deal with the predator issue.

Dr. Joseph Mercola:

Okay. That's fine. It's not a big deal.

Tucker Goodrich:

It's not just a rifle.

Dr. Joseph Mercola:

No, no, no, no. But the big issue is optimizing the linoleic acid content. You've got to be careful. And I would not eat, or recommend anyone eat, chicken meat for a variety of reasons, because it's almost impossible to find it with low linoleic acid content. And it also extends to pigs. So there are other reasons if some people are concerned about that. But so pigs and chicken. See, this is the thing, is the devil's in the details. Many people are big advocates of paleo and cyclical keto. But if you don't understand this fundamental concept of "excess linoleic acid is toxic," then you're going to make massive mistakes that could clearly contribute to premature disease and aging.

Dr. Joseph Mercola:

So I want to get back to the original question, because you said we don't know as to how much, but that's not going to cut. We need to know because we have to make a decision. We can't wait for these studies decades down the road. And I think there's enough historical anecdotal suggestion. If our ancestors ate 2 to 3 grams, why don't we limit it to 2 or 3 grams? I don't see a downside for doing that. I really don't, especially if you're already metabolically ill. Because what we've neglected to mention, unlike sugar, when you eat sugar, it's in and out. You might build some saturated fat stores up, but it's not going to – when you eat excess linoleic acid, it gets integrated in your cell membranes and stored for years. Years. Which is why it's such a problem. So you have got to address this now, not later. So I want a more definitive answer. What's your reason for not limiting it to 2 to 3 grams a day?

Tucker Goodrich:

Before we went on to the excellent chicken tangent, so what I do and what I tell people to do is that you want to avoid all concentrated sources of linoleic acid. Because of my sugar avoidance, I've been reading ingredient labels diligently since I was in my 20s, so this was fairly easy for me to do because I was reading all the labels anyway. So look for chips. Chips are fried in vegetable oils. You can get chips that are fried in better things, like olive oil or coconut oil.

Dr. Joseph Mercola:

Yeah, but both of those oils still have linoleic acid in them.

Tucker Goodrich:

Coconut oil has virtually none.

Dr. Joseph Mercola:

It has some.

Tucker Goodrich:

A tiny amount. Less than tallow, way less than lard. Coconut oil is pretty good. I prefer to cook in animal fats myself, but I do use coconut oil from time to time. If you're looking for-

Dr. Joseph Mercola:

[crosstalk 01:30:44]

Tucker Goodrich:

Beg your pardon?

Dr. Joseph Mercola:

That's a good pearl.

Tucker Goodrich:

It's interesting. It's used as the control in some of these animal model diets.

Dr. Joseph Mercola:

Do you prefer it over butter?

Tucker Goodrich:

No. I mostly use butter.

Dr. Joseph Mercola:

Okay. That's what I thought.

Tucker Goodrich:

Yeah. I mostly use butter. I don't use bacon grease because of the problem with the linoleic acid content of lard from industrial-fed pigs. I used to be able to get pastured pork, but it's super expensive and I have to drive an hour and a half both ways. So that's a luxury item.

Tucker Goodrich:

But you have to understand where it's concentrated. It's concentrated in obvious places, like anything with soybean oil in it, which is every salad dressing just about on the market. I think in all my years before Mark Sisson's Primal Kitchen came out, I was able to find exactly one salad dressing that was made with olive oil and not a bunch of seed oils. So that's one way that people get into trouble, especially if they're trying to pursue a lower carbohydrate diet and they're looking for some healthy fat options, a lot of people start chugging the seed oils in the form of salad dressing. That's exactly what I did. So that's one thing to look for. Any processed food is almost going to have seed oils in it. Chips, obviously, are almost always fried in processed food. But you go to McDonald's, what are the French fries fried in? They're fried in seed oils, thanks to CSPI.

Dr. Joseph Mercola:

[crosstalk 01:32:31] Any fast food restaurant.

Tucker Goodrich:

Yeah, any fast food place. There are a couple places. I think Buffalo Wild Wings actually fries their Buffalo wings in tallow, which is cool. Unfortunately, I'm super gluten insensitive and they are not a gluten-friendly place, so that's a shame. I'd love to go try that. I've made French fries fried in tallow. Oh my God. They're heavenly. So much better.

Dr. Joseph Mercola:

Not too much acrolein in those French fries.

PART 3 OF 4 ENDS [01:33:04]

Tucker Goodrich:

No, you get a little bit, but your body produces and processes a lot of these things. It's amazing. I mean just to kind of step back here a little bit, is it's amazing how many toxins your body makes.

Dr. Joseph Mercola:

Yeah.

Tucker Goodrich:

I mean, stuff that would kill you if you drank it and your body's producing it all day long, like acrolein and acetone.

Dr. Joseph Mercola:

Yeah.

Tucker Goodrich:

And formaldehyde. [crosstalk 01:33:25]

Dr. Joseph Mercola:

The hormesis in small doses, it's actually beneficial.

Tucker Goodrich:

Well, but we also have systems that process these things because it's expected, right? I mean, I'm sure you're aware of glutathione. Glutathione is one of the fundamental antioxidants in the body. And it's so fundamental that if you are missing the gene to make glutathione, you die before you can even be born, right. It's a big problem. Glutathione's major job, or one of its major jobs, is to detoxify HNE and one of the ways that they can tell that you have excess HNE is your glutathione levels are depressed because it's so busy detoxifying HNE.

Tucker Goodrich:

So just again, to kind of step back, what amazes me is people who go to all these measures and I'll hold up my girlfriend as an example. She was a Dr. Greger-style vegan when we got together and had a farm and grew organic food and went to extremes to avoid toxins in food and then went home and cooked with seed oils. And there are so many people who are like this, who are genuinely trying to do their best to have a healthy diet and then they're chugging down this thing that turns into a metabolic toxin in your body. And they wonder why they can't lose weight.

Tucker Goodrich:

By the way, after I told her, what did I tell? I told her what I just said here. Avoid seed oils, avoid refined carbohydrates, eat animal food and animal fats. And she lost 56 pounds in two and a half months like that.

Dr. Joseph Mercola:

Yeah.

Tucker Goodrich:

And her autoimmune disease, fibromyalgia, went into complete remission. So yes, you need to avoid it as much as possible. But the essential fat issue is just, I will touch on that, that lots of health organizations say that you should eat seed oils because it's an essential fatty acid. That is actually not correct. That was deduced in a paper done back in 1930 and another paper just came out and showed conclusively that linoleic acid is not, in fact, an essential fatty acid, that what's essential is a DHA and arachidonic acid, which you get from animal foods.

Dr. Joseph Mercola:

Yeah. I had a friend who looked into that though, into the materials and the methods and the diet that they were using wasn't completely free of linoleic acid. So it's sort of a moot issue though, because you need it. It's almost impossible not to get linoleic acid. If you eat food, it's in everything almost.

Tucker Goodrich:

It's in everything. Yeah. It's moot.

Dr. Joseph Mercola:

Yeah, so you don't have to worry about that.

Tucker Goodrich:

You're totally right.

Dr. Joseph Mercola:

In some ways, it shouldn't be essential because if you eat, you're going to get it.

Tucker Goodrich:

Yes. The only way to become deficient in linoleic acid is to either be in a lab or under the care of a physician. It will not have to happen to you other than those two circumstances.

Dr. Joseph Mercola:

Yeah. So with glutathione, that's a pretty good pearl because so many people use glutathione supplements or glutathione precursors without understanding that well, yes it's nice to have optimal glutathione, but let's get rid of the need to use it by lowering our linoleic acid.

Tucker Goodrich:

That's exactly right. That's exactly right. And then so there's some foods that are [inaudible 01:37:12] like beef has low linoleic acid, even if it's grain-finished beef. If it's grass-finished, it has higher DHA, which is the main difference, which is an awesome way to get your DHA. Although I will tell people that if you can't afford grass finished beef, just eat grain-fed and eat some fish every once in a while. But beef is also the primary source of a chemical called carnosine.

Dr. Joseph Mercola:

Oh yes. On to carnosine now. Yes, indeed.

Tucker Goodrich:

So what does carnosine do? It's been shown to be anti-atherogenic and la, la, la. It's wonderful. Well, I've got this spiffy paper here that if I can, I like to quote these things. [crosstalk 01:37:57]

Dr. Joseph Mercola:

It's a mitochondrial stimulant and it's a dipeptide, two amino acids put together, beta alanine and histidine. And it's a sacrificial scavenger of what, they in the literature call, ALEs, advanced lipoxidation end products, which is very similar to AGEs, advanced glycation end products, which is another name for HNE and all the other reactive oxygen species to be generated from oxidizing linoleic acid.

Tucker Goodrich:

Yeah, so here's the quote. A recent study by Colzani and colleagues analyzed and compared the ability of several classical carbonyl scavengers, and we won't worry about what that is, to prevent the carbonylation of proteins and concluded that carnosine is the most effective scavenger for HNE. So we're back. Carbonylation of proteins is basically the process through which proteins in your body get damaged and become ineffective.

Dr. Joseph Mercola:

It's a big deal.

Tucker Goodrich:

It's a huge deal because there was a paper that I found that I didn't include in my list here. They looked at how many proteins HNE damages in the cell. It damages 24% of your proteins, right? So one of the things, and I mean, they looked at this in various – I've seen work on this in various different disease processes, but I talked about common threads through different disease processes. And I'd like to touch on one right now.

Dr. Joseph Mercola:

Yeah.

Tucker Goodrich:

In heart failure, in Alzheimer's and in age-related macular degeneration, one of the things they see is an inability of the cell to produce enough energy. The mitochondria are getting damaged, right? HNE does that damage. It damages 24% of the proteins in the cell, primarily around energy production.

Tucker Goodrich:

So in cancer, one of the worst cancers is glioblastoma, which is a brain cancer. And there's a researcher up in Boston, Thomas Seyfried, who decided to go look for, try and figure out why the mitochondria are getting damaged in glioblastoma. And what he found was they all have oxidized cardiolipin. Every single cancer cell he looked at had damaged cardiolipin in it.

Tucker Goodrich:

And another part of the cell that gets damaged, one of the ways your cells produce energy is they basically ferment glucose into pyruvate, right, outside of the mitochondria. And this is a perfectly normal part of metabolism and they produce something called pyruvate and then there's a molecule called pyruvate dehydrogenase that takes pyruvate into the mitochondria so the mitochondria can burn it very efficiently for fuel.

Tucker Goodrich:

Well, one of the things that HNE does is it breaks pyruvate dehydrogenase, and they see this in Alzheimer's where their cells are no longer able to produce enough energy, right? This is why your cells are dying in Alzheimer's. The beta amyloid plaques in Alzheimer's disease are induced by HNE. There's a great model that came out of Harvard a couple of years ago showing that. And in cancer, if you can't get pyruvate out of the cell, out of the cytosol, the part of the cell surrounding the mitochondria, it has to ferment there and turn it into energy, which is what we call the Warburg effect, where you start shifting over to this damaged primitive fuel system. And the evidence seems to be that that's because you've broken your mitochondria, right? Even the critical, the most important part of the mitochondria, complex 5 ADP synthase, which is what takes all the energy coming from your mitochondria and turns it into ATP, which is what fuels the rest of your body. HNE damages that protein. This is a huge issue. There's no more fundamental problem in aging and health than protein damage, right?

Dr. Joseph Mercola:

Yeah. All right. Let's go back to a tangent from the carnosine because that is an important one and a point I wanted to discuss with you earlier. One of the paradoxes that just baffled my mind for decades was that why people could eat a keto or carnivore diet and do essentially high fat, low carbs and do really well, and the converse that people could eat low fat, high carb, and do very well too. They can both take care of diabetes. I mean, it's pretty well-proven and I couldn't resolve that. And it turns out, once I understood this linoleic acid, that was the answer. Both of those strategies, typically not always, of course, because you can have high LA foods in carnivore, theoretically is that they both are typically low LA.

Tucker Goodrich:

That's right.

Dr. Joseph Mercola:

And they address the fundamental reason, but what they don't address, if you take the vegetarian approach, is carnosine.

Tucker Goodrich:

Is which?

Dr. Joseph Mercola:

Carnosine.

Tucker Goodrich:

Carnosine. Right, right, right, right, right.

Dr. Joseph Mercola:

Because virtually, there's no carnosine in a vegetarian diet or very little almost.

Tucker Goodrich:

Right, right. Yeah. You're missing these detoxes. There's a hilariously funny paper looking at diet and oxidized LDL, which as we've discussed is the definition of oxidized LDL is LDL with oxidized seed oils. And they couldn't figure out what was going on because they put these people on a healthy, low fat, vegetarian diet or vegetarian-like diet and their oxidized LDL went up. Oops, right?

Tucker Goodrich:

Well as we've discussed, I mean one of the interesting interplays about this and the reason I specifically tell people that they need to eat animal fats is that there are other fats that may in fact be essential fats that we need to eat that you can only get through animal fats. So one of the weirder dietary trivia pieces is if you don't give dolphins this fat called heptadecanoic acid, which is a 17-chain saturated fat, they get diabetes. Why would a dolphin get diabetes? They don't eat any carbohydrates. They live in the ocean. But the lack of that fat in their diet causes them to get diabetes.

Tucker Goodrich:

And that happens in people too. It turns out that people with low levels of these two animal fats, heptadecanoic and pentadecanoic acid, are more predisposed to get type II diabetes. So I think you need to get those.

Dr. Joseph Mercola:

Yep.

Tucker Goodrich:

And there are papers out there saying, is this an essential fatty acid? If you don't get it, you get sick. That's the definition of an essential fatty acid. So I think if you look at the healthiest vegetarian culture that I'm aware of, the Jains in India, they've been at this for 5,000 years, longer than any other vegetarian culture on earth. And they know they have to eat dairy food, that they cannot be healthy without it. And dairy is of course the richest source of heptadecanoic and pentadecanoic acids. So you need to make sure you get enough oleic acid. Well you can do that easily through the diet as well with animal fats because you want to make sure that you're protecting yourselves against this oxidative pathway. [crosstalk 01:45:39]

Dr. Joseph Mercola:

I want to get back to the amount of linoleic acid. But just to your point, I mean, obviously we're both in strong agreement that you need to have some high-quality animal fats in your diet because it's not just the fats, heptadecanoic acid and these other fats, but there are other micronutrients-

Tucker Goodrich:

Yes.

Dr. Joseph Mercola:

-that are in that fat that we probably have yet to discover the benefits that we need. And you don't have to take a supplement. You just take real food.

Tucker Goodrich:

[crosstalk 01:46:09] And there's vitamin K2, there are all sorts of fat-soluble vitamins.

Dr. Joseph Mercola:

Sure vitamin A, vitamin A. So-

Tucker Goodrich:

Yeah, I mean I came across a great paper years ago looking at eating vegetables and they said, "Oh gosh darn, if you eat vegetables without any fat, you don't absorb any of the fat-saturable vitamins."

Dr. Joseph Mercola:

Fat soluble nutrients. Yeah.

Tucker Goodrich:

Yeah. You have to eat vegetables with fat in order to get the maximum nutrient load out of them. You know what I mean?

Dr. Joseph Mercola:

Okay. So I'm going to try for the third time now. I can't get you pinned down.

Tucker Goodrich:

Okay.

Dr. Joseph Mercola:

So 2 to 3 grams, 150 years ago. I don't see any downside for someone who's metabolically ill to lowering their total dietary intake of linoleic acid to under 10 grams. And by the way, there's an easy, easy, easy way to do it. You don't have to send all your food out for analysis. You just enter it into Cronometer and they've got an assay there that says how much grams of omega 6 to the 10th of a gram. And you can just assume that 90% of that's linoleic acid. So what is the downside to limiting your linoleic acid to 5 grams? Other than-

Tucker Goodrich:

There's no downside.

Dr. Joseph Mercola:

Yeah.

Tucker Goodrich:

There's no downside. [crosstalk 01:47:19] You want to keep it as low as possible. [crosstalk 01:47:23] Yes, I do this through what I avoid, right? So let me talk a little bit about what I eat, mostly beef.

Dr. Joseph Mercola:

Okay. I just wanted to get you down to that because to me, that's the take-home message. This is what you need to do to reap all the benefits of this incredible amount of knowledge that you've captured over the last decade.

Tucker Goodrich:

Yeah. You want it to be as low as is possible with the understanding that you'll never get to zero and you don't need to be at zero.

Dr. Joseph Mercola:

Oh no.

Tucker Goodrich:

I just worry about taking that, not understanding that part.

Dr. Joseph Mercola:

If you're eating food, you can't get to zero.

Tucker Goodrich:

Exactly. Exactly right. So I eat mostly beef. I eat vegetables. I cook mostly in butter. I eat a little bit of fruit. I eat occasional grains. Occasionally I'll have corn, a little bit of rice, potatoes, that sort of stuff once in a while. I'm mostly on a keto diet. But once you fix your metabolic system, then you can go back and forth a lot easier and I don't see any reason to be on strict keto long-term. I think it's healthier.

Dr. Joseph Mercola:

No. I'm in agreement. Cyclical keto is the way to go.

Tucker Goodrich:

Cyclical keto. [crosstalk 01:48:33] Absolutely.

Dr. Joseph Mercola:

I switch almost every other day. I'll have 100, 150. Then I go down to 50. 100, 150, for grams of carbs, so.

Tucker Goodrich:

Yeah. I do lots of fasting training. I mean, there's a fascinating paper.

Dr. Joseph Mercola:

Oh sure.

Tucker Goodrich:

They looked at a ketogenic diet in rodents and they found that they were protected and it was fascinating. The reason that they were protected is because they were able to burn HNE as fuel, right.

Dr. Joseph Mercola:

[crosstalk 01:49:05] Okay. You got to be kidding. Are you serious?

Tucker Goodrich:

Yeah. [crosstalk 01:49:08].

Dr. Joseph Mercola:

[crosstalk 01:49:08] fuel? I didn't think that was possible.

Tucker Goodrich:

Yes. They burned it as fuel.

Dr. Joseph Mercola:

Oh, that's the best case scenario.

Tucker Goodrich:

So, but if you add a little bit more insulin into the system, then it turns fat-burning off and HNE goes out of the mitochondria and does more damage, right?

Dr. Joseph Mercola:

That's a reason to work out in a fasted state.

Tucker Goodrich:

Oh, absolutely. That's what I do. I think working on a fasted state is one of the most important health things that you can do without question. And I mean, I'm talking about hours. I go out for three, four or five hours.

Dr. Joseph Mercola:

You're doing cardio. You're doing cardio.

Tucker Goodrich:

I do cardio. I also do some weight stuff.

Dr. Joseph Mercola:

Yeah. [crosstalk 01:49:50] long time ago, but I don't do any cardio now, but-

Tucker Goodrich:

Well, that's a whole other topic.

Dr. Joseph Mercola:

Yeah, yeah, yeah.

Tucker Goodrich:

You know Phil Maffetone, I presume? Know of him.

Dr. Joseph Mercola:

Oh yeah, I know of him. I don't know him personally.

Tucker Goodrich:

Yeah, no I've been following his approach for years. I think he's a bit of a genius.

Dr. Joseph Mercola:

He's a smart guy.

Tucker Goodrich:

Yeah. So anyway, yeah. Now they still get liver failure if they're on a lab keto diet ultimately, right. And that's clearly caused by the omega-6 fats. I mean, this one's back to the TPN, the total parenteral nutrition we touched on a while ago, the Intralipid with soybean oil. They've been feeding this stuff to people for decades.

Tucker Goodrich:

And finally, Boston Children's Hospital figured out that it's the seed oils that are causing liver failure, right. That's the big problem with putting people on TPN is liver failure, especially infants. Because there's something called short gut syndrome where babies are born with guts that can't absorb food and they need to put them on TPN to keep them alive. But one of the things that would happen is they get liver failure and then they figured out, "Oh, it's the omega 6 fats. It's the fact that it's soybean oil. [crosstalk 01:51:06] If we used fish oil this doesn't happen."

Tucker Goodrich:

Okay, so they went to the FDA, which has a black box warning on Intralipid, the highest warning that they have. This will kill you or can potentially kill you. Death is a side effect of using this.

Dr. Joseph Mercola:

Yeah.

Tucker Goodrich:

[crosstalk 01:51:24] And they convinced the FDA to take the black box label off the fish oil product, because it wasn't needed because it doesn't have the toxic effects of the soybean oil product. And they'd looked at all sorts of different alternatives. I mean, I have a slide from the researcher who figured this out and convinced the FDA that it was harmless and every single product that they looked at that contained high levels, meaning more than a fraction of a percent, was harmful to the liver.

Dr. Joseph Mercola:

So what's the best alternative for Intralipid for some type of lipid replacement or fat replacement, because you just can't have sugar. It's not a good idea. You need some fats.

Tucker Goodrich:

The product is called Omegaven.

Dr. Joseph Mercola:

Omega what?

Tucker Goodrich:

Omegaven, V-E-N.

Dr. Joseph Mercola:

V-E-N, Omegaven. I have not heard. I haven't practiced clinical medicine in a hospital for almost two decades, so.

Tucker Goodrich:

Yeah. So the problem is the FDA won't give you Omegaven until you get liver failure from Intralipid first.

Dr. Joseph Mercola:

Oh, nice. Nice. How convenient, how convenient.

Tucker Goodrich:

But in babies, they're allowed to do it because the evidence of harm was so clear. Don't get me started on the FDA.

Dr. Joseph Mercola:

All right. That's another rabbit hole.

Tucker Goodrich:

Yes, exactly.

Dr. Joseph Mercola:

So we're getting close to the end. We've got to tie things together. So any other strong recommendations you have? And I mean, you're in the process of writing a book, which will be out pretty shortly or hopefully shortly, but this all will be consolidated. But you've got a blog and you still continue to research this and read the literature and provide your pearls. So this is so powerful. What are the take-home messages you want people to know, apply, to do, to implement so that they can change not only their health, but the health of their family, the ones they truly love, because this is the number one thing, in my view, after practicing medicine for over three decades, that you've got to do to stay healthy, is you got to limit linoleic acid. So what is it? What do we do?

Tucker Goodrich:

I can't say anything that you haven't already said in this talk, honestly. You want to eat like your ancestors ate because your ancestors were healthier and they were not eating industrial seed oils. They were not eating industrial processed carbs in high quantities. They were making sure that they got lots of animal meat and animal fat and they were getting exercise. I mean, it doesn't really matter what kind of exercise you're doing, just as long as you're doing it.

Dr. Joseph Mercola:

Let me just give it a little insert here because I want to qualify that statement you just made. As you said, our ancestors were healthier. Well, we don't know that because it's individual, but collectively we know absolutely that they were healthier because they didn't have these diseases we talked about. They didn't have heart disease. They didn't have diabetes. They didn't have obesity for the most part or cancer, it was a rare disease. So we know collectively they were healthier.

Tucker Goodrich:

Collectively, right. Yes. Obviously individuals could be better or worse, but I mean there's a paper I found that came out in the 1960s that looked at genetic causation of CVD, cardiovascular disease. And they compared different populations in the 1960s. I mean, it wasn't like this was in the Stone Age or something. And they compared African-Americans to people I think it was in Uganda or Nigeria. And the people in Africa had zero CVD. Zero, right, based on autopsy and looking for evidence of myocardial infarction. They couldn't find any. So this was in the 1960s. And they looked at Japan and Korea and similar findings. These are recent epidemics. And it's, I think pretty clear what's causing it.

Tucker Goodrich:

And I think I have helped so many people in so many different ways by telling people this. And it's typically a short conversation like my girlfriend who cured her autoimmune disease, fibromyalgia, she'd been in constant pain for almost 30 years. And it went away in a couple of weeks, couple of weeks. I mean, that's amazing as she was dropping all of her body fat and everything gets better. It's crazy. And it's so simple to do. This is, I believe the fundamental problem with our modern health is this issue of linoleic acid. There are lots of other things that play into it. There's no doubt about that, but that's the fundamental thing. If you fix that, you can get away with doing a lot of other things that aren't exactly optimal, but still be healthy.

Dr. Joseph Mercola:

Okay.

Tucker Goodrich:

That's my crucial, that's the takeaway.

Dr. Joseph Mercola:

That is, and the benefit of that, or really the high point, the point that you'd be joyful about is it really isn't that hard to do. They take a little bit of willpower and discipline initially, but it is pretty simple and it's not expensive. Well, I guess it can be more expensive to go more carnivore-ish but no, you've got to eat.

Tucker Goodrich:

Yeah.

Dr. Joseph Mercola:

So maybe-

Tucker Goodrich:

But I mean, carnivore, when we're on the road, my favorite thing to do on a road trip is go to McDonald's and get beef patties, which are \$1.29 each. Perfectly healthy. They're delicious. There's nothing in them but beef, salt and pepper.

Dr. Joseph Mercola:

So that's your strategy, huh?

Tucker Goodrich:

Yeah well, I mean, hey, fast food's convenient. I'm not going to go chase down a rabbit-
[crosstalk 01:57:03]

Dr. Joseph Mercola:

No, no, no, no. I'm a little bit more [crosstalk 01:57:05] and if I, as long as I'm gone for less than a week, I will prepare my own food and bring it with me, so-

Tucker Goodrich:

Yeah. I do that as well. But there are times where it's just, "Oh well. I'm still hungry. What am I going to do?" And they're- [crosstalk 01:57:19]

Dr. Joseph Mercola:

So it's very interesting. So your perspective is that the talks, I mean, clearly it's GMO and there's glyphosate and other toxins in there and hormones and chemicals and antibiotics, and probably antibiotic-resistant bacteria. So, but overall you think it's one of the healthier foods you can get? Just throw away everything else on top of it. Maybe have the onions, but-

Tucker Goodrich:

It avoids the major toxin.

Dr. Joseph Mercola:

Yeah. Yeah. It'll work. It'll work. Yeah. So it's just a matter of perspective. Personally I would refrain from doing that too. I don't think I've been at McDonald's maybe this century, but it would work. It clearly would. And from a perspective you are really radically lowering your exposure to the most significant and pernicious metabolic poison and toxin there is, which is linoleic acid.

Tucker Goodrich:

Yes. That's what I think. And I think-

Dr. Joseph Mercola:

Don't have the chicken McNuggets.

Tucker Goodrich:

No, you don't eat the chicken McNuggets. You don't get a soda. You get beef-

Dr. Joseph Mercola:

Or French fries.

Tucker Goodrich:

Yeah. You don't eat the French fries. You get beef patties and coffee, and it's a perfectly fine option.

Dr. Joseph Mercola:

And not very expensive actually.

Tucker Goodrich:

No, and very inexpensive. You can get a nice filling meal for a few bucks and you're on your way.

Dr. Joseph Mercola:

Yeah.

Tucker Goodrich:

You're on a road trip. I think honestly the biggest problem with this whole thing is convenience. When I started 10 years ago and I knew a little less than I knew now. I mean, still the basic stuff I did right off the bat. And it's much easier now than it used to be. I mean especially for somebody like me with a gluten intolerance, that used to be a royal pain and now it's a piece of cake. So you really can eat super healthy in a modern environment if you're just aware of what

that means. What does eating healthy mean? It doesn't mean what the dietary guidelines tell you. It doesn't mean that. You got to not listen to those people.

Dr. Joseph Mercola:

Well, we've got an assignment in front of us, Tucker. We need to help educate not only the public, but the health care professionals who really don't get this. They were at your stage 15 years ago, as I was up until earlier this year. I superficially appreciated the fact that these were dangerous things. I didn't have them, but still, my linoleic acid content was over 10 grams a day, which is I think far less than ideal. So if you want to optimize your health, especially improve your longevity and just essentially eliminate these degenerative diseases, that's the strategy. And we've got to educate people. And once you're educated, you've got to continue the process. Educate your family members and people they love and spread the message because it's a pretty simple one. And we're giving you the tools to understand the molecular biology and the physiology and the historical anatomical reasons why this is such an important strategy.

Tucker Goodrich:

Yes. Thank you so much for letting me have the opportunity to address your audience. It's been a real pleasure.

Dr. Joseph Mercola:

All right, well before you leave, tell us your blog, which I think is yelling-stop.

Tucker Goodrich:

Yeah, it's Yelling-Stop.blogspot.com. I'm in the middle of this book, which we had a real sympathy conversation prior to talking about this podcast about what a horrible process writing a book is. And I tend to be really data-rich in my posts. So they're not too frequent, but they're pretty filling when they come out. I am very active on Twitter and I'm constantly looking at the literature and posting new things on my Twitter feed and getting into arguments with various people over there. So that's a lot of fun. I'm very busy on that.

Dr. Joseph Mercola:

Well good.

Tucker Goodrich:

And I cross-post everything, so if you look at one or the other.

Dr. Joseph Mercola:

Good.

Tucker Goodrich:

I mean, I don't cross post Twitter to my blog, but all my blog stuff goes to my Twitter feed.

Dr. Joseph Mercola:

Okay. All right. Well, thanks so much and probably have you back on again when your new book comes out.

Tucker Goodrich:

Awesome. Thank you so much.

Dr. Joseph Mercola:

All right.

PART 4 OF 4 ENDS [02:01:26]