Micronutrients - Vitamins: Vitamin B1 (Thiamin)

Transcript

Hello everyone and welcome to our Vitamin B1 Presentation. It's part of the Micronutrients Module and it's Thiamin. Vitamin B1 and Thiamin are the same thing. Sometimes we call it Thiamin and sometimes we call it vitamin B1. Before we begin, I want to make sure that you're aware and that you present to your clients when you're educating them about the vitamins and how it affects them and how it affects their health, that it's from the standpoint of education, that you're not diagnosing or treating any diseases, and that anything I say to you today, if you feel like it applies and you want to run with it, that if you're on medication or under the care of a doctor, just make sure that you work with that person to make sure that it's okay for you.

Let's just jump right in. This is a chart. I'm not going to go through it again but I went through this in the B-Complex. If you want an overview of all the Bs this is where you go but I put this in each of our presentations or at least I tried to so that you have the summary of where we're at and we are at, right here, which is B1, Thiamin. Let's talk a little bit about Thiamin, some general information. It was actually the first vitamin ever to be isolated in pure form. Of course, it's water soluble. You probably knew that. The difference between water soluble and fat soluble vitamins, obviously, is that the fat solubles dissolve in fat and they can get stored in your tissues. You have to be much more careful about dosing. It's in free-form in plants and we'll look at the different forms here. It's in phosphorylated form in animal sources. The two phosphorylated forms that are most commonly seen are Thiamin diphosphate, which guess what, that's Thiamin with two phosphates, and Thiamin pyrophosphate, which is, I believe it's four phosphates.

Thiamin hydrochloride and Thiamin Mononitrate are the forms that we usually see in supplements, although we'll talk more about the supplement forms in a little while. Benfotiamine is a fat soluble form which tends to last longer when it gets into the body so you're not going to have your client peeing it out in six hours like you would with the water soluble forms. It can store in the body and so it tends to yield therapeutic effects over ordinary Thiamin, although when we look at some of the research studies on that, it's not always that clear cut. That's interesting about research in general when it comes to nutrition, is we may look at the pathways and expect a certain response. Then when they actually do studies, it's not as clear cut or predictable as we would have liked but that's the nature of being living, breathing, beings.

This is the chemistry of Thiamin. This is what it looks like. All of our vitamins are organic chemicals so they tend to have the carbon, hydrogen, oxygen, and some of them have nitrogen. Basically, it's got a pyrimidine ring plus a thiazole ring and they're linked by a methylene bridge. That's organic chemistry. I learned organic chemistry. I did very well in organic chemistry. I've gleaned what I needed to out of it and I don't remember all the rings and all the different things. If you do great but when you really want to understand how a vitamin works, you can pull it apart and you can go back to the roots so I wanted you to see what it looked like. Its formula is C12-H17-Cl, which is chloride, N4, nitrogen, oxygen, and sulfur.

There's the different forms of Thiamin that we have. The free-form is the first one. The second one is the diphosphate form. In order to convert between the forms, we require energy, which is ATP. The second one up there, you can see the two phosphate groups sitting off on the side edge, monophosphate, this has one; the TMP that's not as popular or something you see, the Thiamin triphosphate, which is over here and it has three phosphates.

What happens with Thiamin? Well, it's transported through the blood stream mostly in free-form or sometimes bound to albumin. Some of it is transported as Thiamin monophosphate but most of it is in the free-form. 90% of it is in the blood cells, not in the plasma, which means that if you go and just run a test, like a lab test, a serum test and say, "Hey let's see about how much Thiamin I have in there," you're not going to get an accurate result because most of it is in your blood cells, in your white blood cells and your red blood cells. When talk a little bit about how to test for it you'll see that some of the tests that are most accurate are going to be either functional tests or tests that look at the levels in the blood cells. In the red blood cells most of the Thiamin is going to be TDP, diphosphate. Smaller amounts are going to be TMP, monophosphate, or free so mostly the TDP.

Storage, where does it get stored? Well, humans store approximately 30mg of Thiamin, 80% of all of it in the body is Thiamin diphosphate; 80%, that's quite a bit. Conversion from the free-form to TDP requires ATP. If someone is depleted, if they've got mitochondrial dysfunction, if they've got low oxygen uptake, if they've got insulin resistance and aren't getting their glucose into their cells, they're not going to be making as much ATP, which means they're not going to be able to activate their Thiamin for use, which means it's going to have an effect on nerve function and all the other functions we'll start to look that Thiamin is responsible for. Half of all the Thiamin in the body is in the skeletal muscles. The other half is kind of equally distributed between the liver, brain, heart, and kidneys.

How is Thiamin absorbed? Well, like many of the vitamins, the free-form is what's absorbed through the jejunum, right, the small intestine, the part of the small intestine that does absorption and a little bit in the ileum and the duodenum. It's absorbed mostly, the active transport, meaning it requires a carrier to carry it across the cells into the blood stream from the intestine, that's sodium dependent.

That's when it's at low intake so the body has to work harder to absorb the Thiamin when you're not taking very much in but it's absorbed via passive diffusion when the level of Thiamin is higher, which means it's kind of like a gradient in the body between say, the intestinal ileum and the blood stream. The higher level just allows the pressure to cause it to move, the gradient difference.

This is what influences Thiamin absorption and I just put this picture in just to show you all the complexities of it. I don't expect you to memorize it. In the reference materials at the end of the presentation there is details about where you can learn more if you really want to study a particular nutrient. I've pulled out the stuff that I think is most clinically relevant so anything that influences Thiamin absorption is stuff you want to know when you're working with your clients, especially when you're noticing symptoms of low Thiamin, which we're going to see in a little bit but blood sugar irregularities, neural stuff, low energy, there's a lot of things that you're going to see on a regular basis that might be related to low Thiamin.

Things that decrease it, well, alcohol. When people are going out and having their beers or margaritas on the weekends, that can be affecting their Thiamin. There's enzyme inhibitors, called thiaminases in raw fish and raw horsetail, which is an herb that we use quite a bit when we're working with people who have bone problems so that's something to be aware of. When you have somebody do horsetail, if you say you want to do that for a cocktail for helping their bones or their hair, because it's high in silica, you want to make sure that you're actually doing an infusion or a decoction of the horsetail because in the raw state, has thiaminases.

Then there's polyhydroxyphenols that, it's a class of chemicals that inhibit Thiamin absorption. Tannic acid, caffeic acid, and tea, coffee, blueberries, Brussels sprouts, and red cabbage have these. Now, the vegetables and the fruits, if you have somebody that's eating an inordinate amount of these, you can certainly inhibit Thiamin absorption but we're not saying don't have your people eat these things because they are good. If somebody tells you that they're sitting down and eating a couple pounds of Brussels sprouts a day and they're having Thiamin deficiency symptoms, you might have made a connection. Calcium and magnesium interferes and polyhydroxyphenols, okay?

Then, what kind of things help with Thiamin absorption? Well, vitamin C, which deactivates the effect of the polyhydroxyphenols. If you're taking calcium and magnesium or you're having your client take calcium and magnesium, they can go ahead and take some extra vitamin C to help to increase the absorption of the Thiamin and then citric acid, which you find naturally in a lot of foods but it's also used as a preservative in a lot of vitamins and then citric acid deactivates the effect of the polyhydroxyphenols.

Let's talk about the main functions of Thiamin. It's a coenzyme for transformation, for energy transformation, for taking ADP, turning it to ATP, for taking your glucose and taking it through the Krebs cycle.

It's a coenzyme for a lot of those things. We'll look at some of those enzymes. It's a coenzyme for the synthesis of pentoses and nicotinamide adenine dinucleotide, which is NADPH, which is one of the Krebs cycle intermediates, right? You need the Thiamin in order to be able to help synthesize these rings, these pentose rings and also nicotinamide adenine dinucleotide, we like to call it NADPH, then membrane and nerve conduction in non-enzyme capacity. Not all of the functions of Thiamin are related to coenzyme activity. Membrane and nerve conduction, like carrying the signals down membranes and nerves is actually not related to coenzyme activity.

Here's a picture of Thiamin biochemistry. We can go through that in a little bit of detail. We're not going to go through it in a tremendous amount of detail but I wanted to show you how we put it together. You've got what's called the pentose phosphate cycle and any of the stuff, you want to go into more detail you can. I remember in my biochemistry classes we went into a lot of detail on this stuff. What happens when you go into the detail is you understand it but then you don't always remember all of it because you're not going to be using it on a day-to-day basis.

We have, on the ribose-5-phosphate is going to be converted via transketolase, which is a thyroid, TPP, thyroid pyrophosphate dependent enzyme and it gets converted into glyceraldehyde-3-phosphate. Glucose also gets converted into glyceraldehyde-3-phosphate through the glycolysis. Both of these then get to feed into the Krebs cycle by going through pyruvate, pyruvic acid down into and across the membrane into the mitochondria. Once in the mitochondria, one of those big pieces is acetyl-CoA and, remember, we talked before, acetyl-CoA was dependent on pantothenic acid and we see a lot of people who have low energy when they have adrenal fatigue and one of the reasons is they're deficient in this acetyl-CoA. That gets shunted through the Krebs cycle and the spot in the Krebs cycle where Thiamin comes in again is going from alpha-ketoglutarate to succinyl-CoA in a TPP version of it.

We have another place where we know that certain amino-acids, notably the branch chain of acids like leucine, isoleucine and valine, can get converted into energy and the way they do that is by this cycle over on the other side, in the mitochondria The branch chain amino acids get converted down using the Thiamin pyrophosphate down to branch to chain acetyl-CoA, which just slides itself into the Krebs cycle at the succinyl-CoA and then makes its way through.

That's some of the chemistry. Again, you don't have to memorize all of this but I think a picture's worth a thousand words. When you just look on paper, "Oh that vitamin's responsible for energy but you've never seen it involved and active in there. You may not remember it but I don't think you're going to forget now that Thiamin is very important in Krebs cycle metabolism.

Let's look at some of the Thiamin functions, the overall, like not just the enzymatic functions per say but actually what it does that you would recognize. Well, it enhances circulation. It assists in blood formation. It's important in carbohydrate metabolism. It plays a role in the production of HCL in the stomach, which plays a role in protein breakdown. It optimizes cognitive activity in brain function. It's an important co-factor in the Krebs cycle, which we just looked at. It's needed for the proper muscle tone of the intestine, stomach, and heart. It's really multi-factorial. A lot of different organ systems and glands get involved.

When we look at some of the deficiency diseases related to Thiamin, understanding its functions helps you to see why those particular symptoms occur. It's an anti-oxidant and we know we need lots of those in our messed up society today. It plays a role in appetite regulation. It helps as part of a leaky gut protocol to rebuild the mucosa and it has a role in immune function and protection from stress. Wow! It's like very talented, isn't it, this Thiamin?

Let's break it down into a little bit more detail. How does Thiamin work as a co-factor in the Krebs cycle? We already looked at the big picture. On the right hand side of this slide what I have is a picture of, so you see the enzyme and the coenzyme and how that works together and how the substrate comes in. The coenzyme actually activates and speeds up the reaction through that enzyme. There's a bunch of different ones, different coenzymes that Thiamin is responsible. One is the pyruvate decarboxylate, the alpha-ketoglutarate dehydrogenase, and we looked at those in the picture before, the branch chain alpha-keto dehydrogenase and then transketolase that's needed for the pentoses and the NADPH.

Let's look at how Thiamin comes into play with blood sugar balance. We know a lot about blood sugar balance and Thiamin can play an important role in helping people to maintain blood sugar balance for a number of reasons. It's a coenzyme for something called transketolase. It's abbreviated Tk and that's usually the way it's written. Pyruvate dehydrogenase and alpha-ketoglutarate dehydrogenase, this is all intracellular glucose metabolism so intracellular, between cells. Thiamin levels and Thiamin dependent enzyme activities are reduced in diabetics. When we look at them and you measure in diabetics their Thiamin and Thiamin dependent enzyme activities, it's lower in diabetics than it is in the general population.

There's also been a genetic link that has been found for Thiamin and diabetes and that particular is a gene Tk. There's an SLC19A2 gene. There's something called transcription factor SP1 and Alpha-antitrypsin and P53. Those are the genetics so if you get your genetics run and not all the genetics testing is going to test for all these but you can certainly look to see if any of these are tested. Looking at that in your patient, you can look to see if that's going to be something that comes in where they're just going to naturally need a whole lot more of the Thiamin in order to control their blood sugar.

A deficiency of Thiamin definitely has a role in diabetic complications, the damage that happens to the vascular, the lipid profile. Diabetics typically have an elevated lipid profile like high cholesterol, high triglycerides, et cetera, low HDLs, the retinopathies that occur, the damage to the retina, the nephropathies because diabetics end state usually end up with kidney failure, and cardio pathology, and Neuropathy. All of these things that are complications of diabetes, Thiamin has a role in so it's really important in your insulin resistant and your diabetic patients that you're working with them to make sure they have enough Thiamin in their system. When we do a leaky gut protocol we usually incorporate Thiamin as a really important thing to energize those cells so that they can rebuild, the mucosal cells can rebuild.

Thiamin can have a role in cataract formation. There are other nutrients that go with it. Vitamin C is one of them, lycopene, things like that, that can be helpful but Thiamin is very important in the prevention of cataracts. People who have these other nutrients, like vitamin A, and B1, and riboflavin, B2, and B3, niacin, when people have those three Bs plus vitamin A in their diet, they're less likely to develop cataracts. They also need plenty of protein too. When you get enough vitamin C, E, and B-complex, particularly B1, B2, folate, and B12, that may further protect the lens. When you're working with anybody who's getting to that age where they think, "Oh, it's just natural to have cataracts at this age," help them to see that no, it's not just natural. It's just accumulation of some of the deficiencies and excesses that they've had throughout their whole life.

Let's look at Alzheimer's disease and Thiamin. A lack of Thiamin has been show to contribute to dementia. Taking Thiamin orally has been shown to improve the cognitive function of patients who already have Alzheimer's. An absorption of Thiamin is found to be poorer in elderly individuals and that's when the Alzheimer's usually shows up. These are important things and if you can just prevent them by making sure that a certain vitamin is up to speed, how happy will your patients be?

Thiamin has effects on the heart and the brain. People who have CHF, which is congestive heart failure, are usually given some sort of a diuretic so that they can move the liquids out of them and that diuretic can usually deplete the Thiamin. Taking Thiamin supplements is important to know so if you have somebody who's suffering from CHF, congestive heart failure, you want to know that, well, maybe Thiamin is a good thing for me to be supplementing for them. Low levels of Thiamin are associated with depression along with others, in B6 and the other B vitamins that we'll talk about.

Here's a list of some of the things that deplete Thiamin. If you've got signs that the person's low in Thiamin, they're showing some of the signs and symptoms, it's a good idea to go through an inventory of their diet and lifestyle and pull out the things that deplete Thiamin. Gluten is at the tops of the list. Gluten creates an inflammatory gut disease. Gluten can create antibody attacks so gluten is a biggie.

The processed and overly cooked foods will strip minerals from the body so if people are eating a lot of things out of bags, or they boil their vegetables until there's nothing left to them, they have more of a chance of having a Thiamin deficiency.

People who drink alcohol, especially bordering on the excess alcohol but even just mild intake of alcohol, run the risk of stripping the Thiamin out. Things like herbicides and pesticides, so having your people eat as much as possible, organically grown and non GMO food. Some of the refined sugars, and corn syrup, and artificial sweeteners have an effect on Thiamin for the bad. Prolonged stress and we all have people that we're working with that have been under stress for a long time; that definitely depletes Thiamin. Eating table salt, but not sea salt; table salt tends to strip away the Thiamin. Drinking tap water, that contains sodium fluoride; that tends to strip the Thiamin. When people eat a lot of soy products in an unfermented soy so they're eating soybeans, and soy protein powders, and tofu, which those are not fermented soy and those have an inhibitory effect on Thiamin.

In regular or decaffeinated coffee and tea, it doesn't matter whether it's decaf or not, it's not the caffeine per say, it's others of the alkaloids and chemicals in the coffee and the tea that tends to deplete Thiamin, any thiaminases in there. Then if somebody takes too much zinc and too much vitamin A it can deplete Thiamin so we're always looking for that Goldilocks principle of the exact right amount, not too much and not too little.

What are some specific things that can cause Thiamin deficiency? Well, health conditions, and those can be alcoholism, Crohn's disease, anorexia, kidney dialysis; all of those can lead to depletion of Thiamin. Well, of course growing in deficient soil, which is happening more and more as people are using more, relying more on pesticides, and herbicides, and not giving back to the land. Processed foods, which is abundantly high in our society. Fluoride, which almost every municipality, at least here in the US, is putting into their water to prevent tooth decay, interferes with Thiamin. A variety of different drugs, like antibiotics, Dilantin, Phenytoin, sulfate drugs, oral contraceptives, heavy caffeine consumption and a high carbohydrate diet; all of these have been shown to deplete the Thiamin.

What people don't realize is when they take in foods that are deficient in their B vitamins, so they're taking in their flour products, or their pasta, not if it's gluten free, but it's white and refined, what's happening, it's not just that they're not getting those nutrients that should have been in there that were stripped away during the refining but since your body needs those nutrients to go through the Krebs cycle and generate energy, then it's actually robbing the body of whatever you have if you have any of those other nutrients in there. If you don't, then you're kind of messed up.

Let's look at some of the things that Thiamin deficiency will cause: Headaches, nausea, fatigue, well those are kind of vague symptoms. A lot of different conditions cause it so you really are playing detective when you're trying to figure out what's going on with a person.

All right, so they have headache, they have nausea, they have fatigue. They're irritable. They've become depressed. They're telling you they have abdominal discomfort. They're having difficulty digesting their carbohydrates. That can cause a build-up of pyruvic acid and that can result in loss of mental alertness, difficulty breathing, and heart damage.

Again extreme deficiency is a condition called beriberi but you don't have to have the ultimate extreme deficiency of something to have a wake-up call. This is where we come in because we're helping people to identify before this becomes a serious problem, whereas in medicine it's like, well unless you have beriberi, they're not going to say you have a Thiamin deficiency. Maybe it's not a true deficiency, it's just an inefficiency, this chronic walking wounded type of manifestations, like, "Oh no, I'm not bad enough to be in a hospital but I'm just not right." That's where you come in to help folks.

Let's look a little bit more carefully at beriberi. What are some of the manifestations? There's two different kinds. There's wet, which contains edema, and dry, which looks like body emaciation and body wasting. Some of the symptoms that we're going to see in people that have this deficiency are confusion, difficulty breathing because they have an accumulation of fluid in their lungs, something we call nystagmus, which is this uncontrolled eye movements, they just go back and forth, back and forth, anorexia, loss of appetite, and weight loss.

Then some neurological symptoms like apathy, confusion, short term memory loss, and irritability. Then cardiac manifestations, which would be overgrowth of the heart, hypertrophy, altered heart rate, and swelling of the heart; it could actually cause swelling enough of the heart that the heart just can't give out and death can ensue. Then swelling, tingling, or burning sensation in the hands and the feet. Beriberi is super rare in the developed worlds, except with alcoholics. It's very common it happens to people who are alcoholic and have been that way for a long period of time and just stripped away all their B vitamins.

Another kind of severe Thiamin deficiency is a condition that's known as Wernicke-Korsakoff syndrome. It's common, again, in alcohol users. It causes a loss of short term memory, that jerky eye movement, a staggering gait, encephalopathy, nystagmus, ataxia, which is the, "Wheeee, I'm having a hard time walking," and opthalmoplegia, which is kind of paralysis of some of the nerves in the eyes, which makes is unable to move the eyes very well. What you're seeing on the right are some brain images of people who are moderate drinkers versus alcoholics. You'll see that this part of the top is the front part of the brain and this is the back part of the brain. Look at the difference. Look at how much missing tissue there is in this alcoholic person.

Some pictures of some Thiamin deficiencies diseases, you'll see the dilation of the heart on this right one, the x-ray over there. You're seeing problems with the eyes. See, they're just kind of permanently turned in. This person looks like confused. He looks like he's going into a coma too and then this one guy at the top on the upper left.

Dyspnea, which means difficulty breathing and cyanosis, which is very blue, the lips turning blue; these are things you can be looking for. Hopefully you don't see them very often.

This is just a cutout from our nutrient assessment chart that's on your website, on the INE website. What happens if you take too much Thiamin? Well, there's very little risk of toxicity. They've done studies with people taking 500 mg or more per day and really not seen very much. People who have taken a hundred times the RDA parenterally, meaning in their IV fluids, have had experiences so these are the things that you would want to be aware of. It's rare but this could cause somebody to have headaches, convulsions, arrhythmias, or a risk of anaphylactic shock.

Let's look at the interactions. All drugs and herbs have some sort of action with other either herbs, or drugs, or nutrients and Thiamin is no different. We talked briefly already about horsetail, also known as equisetum arvense that contains a thiaminase enzyme that inhibits Thiamin. Digoxin, which is used for the heart, it may reduce the ability of the heart cells to absorb and use B1 and it's especially problematic when you combine it with Lasix or furosemide and that's a diuretic. In general diuretics, particularly Lasix, help reduce the levels of vitamin B1. Then Dilantin, which is used a lot for seizures, can cause a low level of Thiamin in the body.

Thiamin status, the serum is not accurate. Remember we talked before? Most of it, 80% is actually in the blood cells. Spectra cell measures the level in the white blood cells so that could be a good way to do it. You can do functional tests like going to the erythrocyte transketolase. You're basically functional testing for vitamins that have cofactor activity. The functional tests are when you figure out a function. Let's just say a particular vitamin like Thiamin converts chemical A to chemical B and if you measure in the bloodstream, you measure chemical A and chemical B, and there's a lot of chemical A but not a lot of chemical B, that gives you the suggestion of a functional impairment of that particular cofactor. Make sense? Some of the tests that you can do, there's a test called NutrEval by Genova, and that tests all of the vitamins, and minerals, et cetera. You're just looking for the signs and symptoms and taking a good history can often be helpful as well.

RDAs for Thiamin, they're not that big. They're actually not that big. When you look at B vitamins, you usually see huge doses in those B vitamins, like 100 mg, 50 mg, 25 mg. The RDA for an adult is 1.1 for female and 1.2 for adults. That's not very much at all.

How do you replenish, right? What do we do? Well, foods and herbs. Foods that are high, I'll give you a list of those. I'll give you some herbs. Oral supplementation, and I'll show you the variety of ways you can do that. You can do intravenous. They often times do something that is called a Myer's cocktail, which is a bunch of B vitamins with vitamin C, and that's intravenous, and then intramuscular. Those are all methods for measuring.

Okay, this is a list of Thiamin foods so some of these may be undesirable for other reasons, like allergies, or you're avoiding the top six allergens, somebody is vegetarian, peanuts, I don't think are a real good food in general but this is what's considered good food sources. Use your judgment with going through these to help people to choose what they can eat or not eat at any given point in time. Brown rice tends to be a higher glycemic food so some people with glucose problems don't do well with it. Egg yolks, very high on the allergy list, it's one of the top six allergies. Fish, legumes, liver, all of these things could be helpful as long as they're properly prepared, that they're organically raised as much as possible. You just go through this list, asparagus, and dolce, and broccoli, there's a lot of great places. Keep these lists handy so that you can easily refer to them when you're helping people to get over it.

There's a lot of herbs high in Thiamin. I was shocked at how many herbs there are that are high in Thiamin. These, a lot of these are just common herbs, like paprika, and parsley, and peppermint, and raspberry leaf. Then there's some more esoteric ones like, let's see, catnip, we don't usually us a lot, shepherd's purse, things like that but all of these can be used either in foods, like have people, if they like the flavor of some of these to put them in a little container and just sprinkle them on their foods. Sometimes they can be hidden in smoothies or soups so it's a really good idea if you've got somebody you're working with who's low in Thiamin to help them to get the herbs. This is from my favorite place to look up food chart type things and that's whfoods.com. That's their Thiamin chart.

What are some of the forms in which people supplement with Thiamin? Well, the most common form is the least expensive form, is Thiamin hydrochloride. They put that in your multivitamins and a lot of the over the counter stuff. Thiamin pyrophosphate is an active form of the vitamin. This is a list of some of the enzymes that it works with, pyruvate dehydrogenase, pyruvate decarboxylase, and ethanol fermentation, alpha-ketoglutarate dehydrogenase, branch chain amino acids, and hydroxy- I don't know if I can say that one, indoleacetic.

The last one I'm going to talk about, and I've got a few slides on this one because I want you to understand it, is benfotiamine. It's the up and coming in the Thiamin worlds. It's a fat soluble form, a lipid soluble form and it gets into the cell membrane much better than regular Thiamin. It's been shown to be very helpful in diabetic Neuropathy and also in reducing those microvascular tears and things that happen when the blood sugar gets too high. Transketolase has the ability to reduce what's called advanced glycation end products, also known as AGES, by directing those precursors into the pentose phosphate pathway instead of down the pathway to AGES. Pretty cool.

Let's look at benfotiamine and its absorption and structure. Some of the studies have shown about a 5-fold increase in absorption over regular pre-thiamin and then a 3.7-fold increase over the Thiamin hydrochloride. When they measure serum for detectable signs of it, they're actually detected within an hour of taking it, which is pretty quick.

I won't try to say this whole thing, but this is the structure, S-Z-amino-blah, blah, blah, blah, blah. I gave you the picture but if you ever see it, you know what it is. I was trying to impress you. The common dose is between 300 and 600 mg a day over the course of the day. I usually use, I usually have people, like if I'm trying to repair a leaky gut or they've got some diabetic kind of complications, I'll usually give them about 150 mg, three times a day but I have gone higher than that in really severe cases, especially if somebody already has some written up that these are neuropathies.

Here's some of the research of the diseases and conditions that it's been shown to potentially be helpful with, Alzheimer's, pain, cardiac tissue improvement, glucose metabolism, skeletal muscle and bone, inflammation, immunology, oxidative stress protection, lungs, kidneys, and eyes. Here's a few studies. There was one with Alzheimer's where it, because the benfotiamine attenuated the glucose induced increase in the beta-amyloid protein synthesis and normalized the glutathione ratio between glutathione and glutathione disulfide in the cerebral cortex. They were seeing improvements in the memory and the cognitive function in Alzheimer's people.

The benfotiamine in the studies would weakly, it's not powerful, but it definitely does it in a measurable fashion, weakly attenuates the advanced glycation end products that are bound to serum albumin and keeps them from activating macrophages and inducing oxidative stress. In other words, when we have adequate B1, and the benfotiamine was used to study this, it prevents the activation of macrophages that induce oxidative stress, the slowing down these AGES. It also attenuates LPS, lipopolysaccharide induced mitochondrial membrane potential loss in the macrophages. LPS, we know, is an endotoxin that gets produced by some of the bacteria and the organisms that overgrow in our intestinal tracts.

Here are some resources that you can look at. They're some pretty good stuff. Then here's some research. These are just some research studies. If you want to go deeper with this, you know, for some reason Thiamin is calling your name and you want to go deeper with this, go ahead and go for it.