Micronutrients: Chromium

Transcript

Welcome to our micro nutrients presentation on the mineral chromium. I'm excited to share with you about this really special nutrient that has a lot of very significant roles in your day-to-day. It doesn't have a lot of roles, it has a lot of importance, let's just say because it's so integral to maintaining blood sugar balance. Let's just jump right in and begin.

Before we go too far, I just want to make sure that everything that I share with you, and everything that you get to share with your clients is not intended to replace a one-on-one relationship with a qualified healthcare professional, and it's not medical advice. Unless you're in a position where you are sitting face-to-face with a client, and you have the license to diagnose and treat, you want to make sure that they're aware that this sharing is knowledge and information from your research, from your experience, from mine, and that it's just education, and that you would encourage everybody to make their own healthcare decisions, and this goes for you as well listening to this presentation, and thinking about what can be useful for your own health and well-being.

Let's just dive right in. Chromium is an essential trace mineral. It's ubiquitous in that it's all around us, it's available in a lot of places. Chromium is CR0, it's just the basic co-form of chromium. The form that's important in the body is a positive form of it, a covalent, tri, it has three molecules of chromium stuck together, or three atoms of chromium stuck together.

The thing about it is the most, the biggest claim to fame it has is in maintaining insulin balance. There are a few other less important functions that it has, but most of the important function and the effect that it has in the human body is related to its effect on insulin, and we'll go through the details about that.

It was first discovered back in 1797, and the most stable oxidation state of chromium in the biological system is what's called the trivalent, Cr3+. When it mixes with proteins, nucleic acids and other things, it forms inert complexes, it's not something that's going to go around and scavenge things up, or do a lot of damage, it's pretty stable and inert, the molecule stays the same.

There is another common form of chromium, which is also stable, which is the hexavalent form, and the hexavalent form is not something that's found in the human body, it's a toxic form, and it's classified as a human carcinogen.

If you inhale this, it's a carcinogen, so this is not the chromium that you're going to get when you supplement yourself, or suggest that your clients supplement themselves with chromium. It's derived from the trivalent chromium, so put that in with heat at a very alkaline pH, and it's used in industrial purposes, so it's again not the form that you're going to have people supplement with, or the form that's in food. In the acidic environment of the stomach, the hexavalent chromium can be broken down to trivalent by some of the reducing substances in food.

It keeps us from getting this dangerous substance into our body, so if you accidentally ingest the hexavalent form, it's going to be broken down, assuming the person has sufficient stomach acid. There we go again with the stomach acid coming up as important in so many different ways.

Let's talk about what chromium does in the body, and we'll talk about how it does some of these things as well. It enhances the effects of insulin on target tissues, it stimulates fatty acid in cholesterol synthesis, it's involved in carbohydrate, fat and protein metabolism, especially related to the way it affects insulin. The inorganic form of chromium doesn't potentiate the insulin action, and it has to be converted to an organic, biologically active form. It's not just any chromium that's going to have an effect on the glucose transport and the insulin receptors.

Trivalent chromium is proposed to be the cofactor for a specific oligopeptide, remember what oligopeptides are, they're short chains like amino acids strung together in short chains, not super long, and not super short, so it's those in-between state, oligopeptides. It's a bunch of amino acids strung together. There's a particular one called chromodulin, and it's in particular this chromium is a cofactor for it, and we'll see where chromodulin comes in when we look at some diagrams in a bit.

Chromodulin improves tissue sensitivity to insulin, and facilitates the transport of glucose into the cells. Chromodulin is when we take chromium for blood sugar balance, it's the chromodulin that's actually doing the job, and chromium is a cofactor for creating that.

Let's take a look a little bit deeper, and I'm going to give you a lot of details today, and the point of me giving you a lot of detail is so that you understand how these different nutrients are working in the body. Not that you're necessarily going to memorize and memorize valent states and all this other stuff, you're going to memorize the overall reaction, as opposed to just saying, "Oh yeah, that's chromium, it's good for blood sugar," you're going to understand why it's good for blood sugar.

Let's talk about chromium and insulin sensitivity. We know that in order for sugar to get into the cells, it has to be transported by insulin, but that insulin needs help in getting the sugar in.

Once the sugar is bound to insulin, insulin then needs a carrier to help it get into the cell, it needs nutrients to help it get into the cell. In terms of chromium, it binds to something called apochromodulin, which is a form of the chromodulin that doesn't have the chromium yet. You've got this apochromodulin floating around, it's waiting for the chromium to activate it. The chromium binds to the apochromodulin, and then the chromodulin binds to the insulin receptor, and it creates the up regulation of insulin signalling. This increases the translocation of something called the GL GLUT 4, the glucose transporters into the cell membrane, and this is what facilitates the movement of the sugar into the cell. It's a complex process, and we can see that there's a lot of places where this can break down.

The diagram at the bottom you see the insulin latched onto the chromodulin, right, the chromodulin is not useful unless the chromium is there. If somebody has a deficiency of chromium, they're going to be missing this piece, and the insulin is not going to be able to take the sugar into the cell.

It's a really cool process when you think about it, how interrelated all these things are, and I think it's kind of fun, maybe I'm just a geek and I like those sorts of things, but I think it's kind of fun to know how these nutrients are working. "Oh yeah, chromium is good for insulin." When you understand how it works, you go, "Oh my god, imagine if you don't have the chromium, then there's no way that the insulin is going to help the sugar to get transported into the cell."

Chromium inhibits the activity of something called protein tyrosine phosphokinase and other negative regulators of insulin signaling. If we've got a buildup, the receptors have been damaged, we've got a buildup of this protein tyrosine phosphokinase, then the chromium actually inhabits the activity of that so we can actually bypass that and get the sugar into the cells.

It improves insulin sensitivity under insulin resistant conditions, so the person becomes insulin resistant, and you give them a whole bunch of chromium, and suddenly they're able to get the glucose into the cells, and we know from clinical experience that this works rather quickly. Haven't you seen those folks who you're working with restoring their insulin sensitivity, and you just get them on some chromium and suddenly they're starting to feel better, they're starting to have less sugar cravings, they're starting to have the ability to drop a little bit of the extra weight. You can't just do that, but it's part of the process, and it's one of the first things I personally do when I'm working with people, get them on some chromium.

I've watched clients respond amazingly well. I've watched one person who came in with clear insulin resistance, PCOS, her sugars were ... Her fasting glucose was right around 120, right below 120, 119, but in some tests it was actually higher, but it wasn't consistently above, so they didn't diagnose her as diabetic, but did diagnose her as PCOS, and we put her on this high dose chromium that was mixed with other things.

It was a product, I believe it was a Pure Encapsulations product that I put her on, and it had the chromium and magnesium, it had a whole bunch of different stuff, it was called Gluco Balance or something along those lines, I'd have to look up the exact name. Within, I would say, 2 to 3 weeks, she was able to curb a lot of her sugar cravings that were just driving her nuts, and she got her fasting blood glucose down into the 80's, and it's staying there, it's staying there, it's been there for 3 or 4 months now, so that's really cool.

Chromium also reduces the clearance of insulin, and enhances insulin signaling by inhibiting the proteolysis of insulin. What's proteolysis? That's when you take something that is a protein molecule and you break it down, the breakdown of protein. It inhibits the breakdown of the insulin and some downstream effectors while making the insulin receptors more sensitive, which means a lot more sugar is going to go into the cells. That's cool.

It also reduces oxidative stress and inflammation that's known to contribute to insulin resistance. It has two different mechanisms by which it's helping the insulin resistance. One, it's a cofactor for the chromodulin molecule which latches onto the insulin and allows it to get attached to the cell and stimulate the GLUT receptors and allow the sugar to go in. It also reduces the oxidative stress and inflammation, and we know that that's a critical part of insulin resistance and restoring people from insulin resistance is helping them to manage their inflammation.

Let's look a little bit more closely at insulin signaling, and kind of a review, but going into it in a little bit from a different angle. There's an oligopeptide, a low molecular weight chromium binding substance, abbreviated LMWCR that tightly binds 4 chromic ions. It binds to to the tyrosine kinase active site of the insulin receptor and then chromium is readily transferred from transferrin, which by the way, is also a carrier for iron so iron and chromium compete for transferrin, to this apo-LMWCR at a near-neutral pH. W

hat is all that mean? Well, do you have to memorize all this stuff to be effective in clinical practice? No. No, no, no. It's understanding that there's a variety of mechanisms by which this works. Then the release of the chromium is related to a mechanism by which the chromium, the picolinate, that's the trivalent chromium picolinate may generate hydroxl radicals in the cells. Trivalent chromium may be the cofactor of a low molecular weight chromium binding substance or chromodulin, that's what we talked about before. Chromodulin is believed to enhance the cascade of signaling events induced by the binding of insulin to extracellular alpha-subunits of the insulin receptor.

Basically what this means is that chromium, in a nutshell, the chromium is a cofactor binding to this module, this apochromodulin, into chromodulin, which binds the chromium, which attaches to the insulin, which helps the insulin to allow the sugar to enter the cell.

You can read all that if you want to and you can read the reference to it if you want to go into more detail. I wanted to show you a picture. In the first picture, you see the glucose, those little red dots floating around in the space, you see the insulin floating around in the space. You see the glucose channel is closed. Nope, can't get in, can't get in, can't get in. You need the password so you've got, in the second picture, the insulin then binds to the receptor and then you see the glucose channel is starting to open and then you see the chromodulin and the chromium. The chromium and the chromodulin are sitting there. In the third picture, you see the the chromodulin and the chromium bind together and in the fourth picture, you see the chromodulin and the chromium attach to the receptor and then the receptor further opens up the channel and allows all the glucose in.

That's it in a nutshell. A little bit more than maybe you wanted to know. What happens though with chromium deficiency? Whenever they\re wanting to look at what happens with particular long-term deficiency of a particular nutrient, is they put somebody on parenteral nutrition. These are people in hospitals, these poor people get to be guinea pigs, who are on IVs and they're just fed strictly through the tube. When they didn't put the supplemental chromium into their IV solutions, they developed abnormal glucose utilization, and increased insulin requirements that responded when they did put the chromium in. My guess is that they don't necessarily do these things deliberately but they find out by accident, like, "Oh, I guess we need to add chromium to that parenteral nutrition." And, "Oh, I guess we need to add some essential fats to that." "Oh, I guess we need to add that." They find it out by not having done it and this happens a lot. Now the intravenous solutions will provide chromium at doses well above the dietary levels so that's a good thing.

Chromium deficiency results in impaired glucose tolerance, we already went over that. Chromium insufficiency is a contributing factor to the development of Type II diabetes. That makes total sense. If you've got insulin resistance because of having a chromium deficiency, or that's part of it, you run the risk of developing Types II diabetes. We find that in chromium deficiency, there's a higher levels of Type II diabetes and if you check people with Type II diabetes for chromium, you're going to find that they have a lot lower level of chromium.

Urinary chromium loss is increased by endurance exercise so when people are exercising, they have to be taking in more chromium because you're going to pee it out. This is important to know because people say, "Do I have to keep taking chromium after I've gone through a metabolic reset and helped myself with my insulin resistance?" The answer is, "It depends." It depends on what's going on. If you're eating high carbohydrate foods and have a higher demand for insulin, and are stimulating more, yes, you need to keep taking it. If you're an endurance athlete, you're doing a lot of high intensity athletics, you may need the extra chromium to make that up.

Resistive exercises increase chromium absorption. This is another reason for wanting to do a combination of exercise. You don't want to have somebody just doing endurance exercise, like running marathons, if that person is not also lifting weights, because you're losing the chromium when you're doing the endurance exercise, but then when you're doing things with resistance, you're going to increase its absorption from food and from supplements.

How does chromium play into cardiovascular disease? Impaired glucose tolerance in Type II diabetes are associated with adverse changes in lipid profiles and increased risk of cardiovascular disease. What does that mean? When you've got high levels of insulin in the system and high levels of glucose in the system and it's not getting into the cells, the vessels become rigid. They become stiff. There's an effect on the ability of those vessels to respond to stress, to needing to be expanding and contracting. When there's a buildup of plaque in the arteries, then that plaque, that calcium deposit, if it breaks free and it gets lodged into a vessel, if the vessels aren't elastic the way they're supposed to be, they can't expand, contract, then you can have a cardiovascular accident or a heart attack or a stroke.

With chromium deficiency, we see higher cholesterol levels. We see higher LDL levels and higher triglyceride levels. Because of its effect on this insulin metabolism, when we see an improvement in chromium status, we see increase in HDL levels so when the chromium status is improved and the glucose tolerance is improved, and the ability to get sugar into the cells and then make energy is improved, we're going to see decreases in cholesterol and increases in LDL. On the other extreme, when we have somebody with diabetes, then we have somebody with insulin resistance, we're going to see increases in cholesterol, LDL and triglycerides and lowered HDL. We know one of the ways that we measure ... one of the measurements for insulin resistance is looking at the blood test and looking at the level of triglycerides to HDL, that ratio. We like it ideally to be around 1, 1.5 would be fine but when when it gets up above that, we're at higher risk for diabetes. We're more saying, "oh, this person probably has an increased risk for diabetes or insulin resistance."

Let's look at chromium and muscle mass. In studies they're seen that chromium supplementation increases lean body mass and decreases body fat. That's what we want. A healthier body has less body fat and more lean. It has to with what? Well, going back to the chromium and insulin action. Insulin affects fat and protein metabolism and it regulates glucose metabolism, of course.

Let's look at chromium with relationship to diabetes specifically. Well we obviously know that it regulates insulin sensitivity and glucose levels. Those are the overt Type II diabetes for over 2 years, have higher rates of urinary chromium loss than healthy individuals. Chromium supplementation with Type II diabetes reduces insulin concentrations and improves the blood lipid profiles. It's really a critical nutrient and many people don't get enough of it or they lose a lot of it because of the diet, because of the way that they're using the chromium over time. They're just using it up and then they run out.

As a result, we postulate that chromium supplementation is beneficial in the treatment of Type II diabetes. This is not something that every ... your average internist or even endocrinologist is aware of. More and more of them are becoming aware of it but most of them are not thinking, "Oh, we've got this person who's insulin resistant or on the verge of being Type II diabetic, why don't we just give them some chromium?" No, it's like, "Why don't we put them on insulin if it's too far gone, why don't we put them on Metformin or some of the other glucosphage or some of the other medications? Chromium is super important and we know that it's not just chromium but we're talking chromium today and it's super, super important. Chromium picolinate, this is a study that was done at 200 micrograms a day or 1,000 micrograms a day associated with reduced insulin concentrations, they did this study with both levels. Most of the studies have been done with chromium polynicotinate and the reason is chromium picolinate can be toxic at high levels and chromium polynicotinate doesn't seem to be.

Hemoglobin A1C is also significantly reduced with chromium. When you get somebody on chromium, if you measure their hemoglobin A1C before and after, you're going to see a reduction in it. Hemoglobin A1C is the measure of how glucosylated, how sugar-coated the red blood cells are. Chromium intake of at least 150 micrograms per day for no less than 3 months significantly reduces fasting glucose concentrations in diabetic subjects but doesn't have an effect on the hemoglobin A1C. It seems like it must have much higher doses to have an effect on hemoglobin A1C. By the way, there are some resources and studies where a lot of this information can be found if you want to go deeper. That's at the end of the presentation.

Larger doses of chromium needed to observe the beneficial effects and around ... most of the studies show around 800 micrograms per day seems to be effective for most people. Some people, smaller people may need less, people with less severe insulin resistance and some with more longstanding Type II diabetes may need more, as much as 1200 micrograms a day.

They took a study with women with gestational diabetes and they supplemented them with 4 micrograms of chromium picolinate per kilogram so if you figure your average woman, let's say per kilo, let's say a 50-kilo woman times 4, that would be about 200 micrograms of chromium. Even at that low dose, in these women with gestational diabetes, meaning diabetes in pregnancy, they did it for 8 weeks and they found that they had fasting glucose levels that dropped and their insulin dropped. It was the same as those who took ... compared to those who took a placebo. So same as people who were more normal, who didn't have the problem.

But chromium, like everything else, we have to look at toxicity. It doesn't have a high level of toxicity in the normal state, in the type we're going to be taking as supplemental or in food. Hexavalent, as we talked about, is recognized carcinogen and exposure is associated with an increase in lung cancer and dermatitis.

Little evidence exists, there's very little evidence that the trivalent form of chromium, like chromium polynicotinate, chromium picolinate, in the trivalent form, is toxic and there are a few little, here and there, studies and indications that high levels might be dangerous but very, very few. The toxicity from the oral intake is considered to be low. Ingested chromium is poorly absorbed so that's why you have to take larger amounts to get the right amount and like we said earlier, increasing in resistive exercises is going to increase the absorption but more heavy-duty exercise is going to increase the elimination and then eating a lot of carbs and stuff if going to increase the elimination too.

Really, the kinds of studies that they've looked at have not been convincing with regard to toxicity so the Food and Nutrition Board of the Institute of Medicine didn't even set a tolerable upper limit, which is kind of unusual.

Let's look at chromium absorption. It mostly happens in the small intestine, mainly in the jejunum and it's absorbed via active transport or and diffusion. As is typical of nutrients, if the quantity present is high, then it's diffusion, meaning it just passes through the membranes from the intestinal lumen into the blood stream but if it's very low dose, then it requires an active transport, meaning a carrier to take it and bring it across the membrane, which means it requires a little bit more energy to do so.

How is chromium transported and stored in the body? Well, it uses the same carrier as iron for the most part, transferrin. Also can be bound to albumen, to be transferred around. One of the things with the transferrin, it means that if somebody is taking super high, high doses of chromium, they may need to be concerned about the iron being transferred around in their body so that's something to look at when you're looking at people, if they have low iron and they're taking high doses of chromium, to try to weed out whether that's an issue. It's also stored in various places, mostly in the kidney and liver but kidney, liver, pancreas, muscle, heart and bone are all the places where chromium stores can happen in the body.

What influences chromium? Simple carbohydrates like sucrose, fructose and glucose will decrease the absorption and will increase the need for the chromium and then increase the urinary excretion of it once it's used up. Phytates, which are found in some grains, and they inhibit not just chromium but they inhibit zinc and other minerals. Zinc supplements can actually inhibit it. Corticosteroids and other drugs, so steroids, antacids, and H2-blockers, proton pump inhibitors are types of antacids, niacin can inhibit it. Beta blockers and niacin generally in those really high doses that folks are taking as a cardiovascular preventative. Beta blocker drugs, insulin, NSAIDS and even the new horsetail as an herb.

Horsetail, it's usually raw horsetail, it also inhibits thiamine but horsetail herb has been shown to decrease the effect of chromium. Taking too high a dose of horsetail is not a great idea. Taking moderate amounts is a good idea because it provides silica and other great things for bones and teeth and hair and nails but you be careful, just make sure you do extracts of horsetail or you do the ... not tinctures, infusions or you do the decoction, so you're heating it, not just doing it raw. I used to have people put horsetail straight into their smoothies but I stopped doing that.

What else? What increases the chromium and the chromium ... the ability of it to do it's job are Vitamin C and the amino acids methionine and histidine. These are all things to keep in mind when we're looking at people, whenever we're evaluating people for a specific nutrient imbalance or nutrient excess and you want to keep in mind some of the confounding factors.

How does chromium and iron ... well they compete for transferrin because transferrin is the iron transport protein and chromium also competes for it. Especially in a case where someone is low in albumen, which we see a lot, folks being low in albumen when they have protein malabsorption or low stomach acid, or insufficient protein. Hemochromatosis, which is a hereditary condition that leads to iron overload will interfere with chromium transport by competing for transferrin binding. What that means is that if you're working with somebody who has hemochromatosis, that you're most likely going to see that they have problems with insulin resistance because their hemachromatosis, the iron is interfering with the chromium. You really have to make sure in people who have hemochromatosis, that you're making sure that they have sufficient dietary and supplemental chromium. Yes, when you look at it, you look and say, "Well, yeah, there's a lot of folks who have hemochromatosis who also have diabetes or at least insulin resistance."

How does Vitamin C? Chromium uptake is enhanced when you give it with vitamin C. When you're having people do their supplementation for say, insulin resistance and you're giving them higher doses of chromium, you want to make sure it's absorbed, then go ahead and give them the vitamin C at the same time, which is not a bad idea. I typically have people take chromium for insulin resistance like 3 times a day with each meal and Vitamin C is really good to be taking 3 times a day so why not take it with the chromium?

There were, this was a very small study, it was just 3 women but giving 100 milligrams of Vitamin C with a milligram of chromium resulted in higher concentrations of chromium than without the Vitamin C. There's a lot of these studies around. That's a small study but it definitely bears out in the biochemistry.

What can cause deficiency? Well, of course, deficiencies in the soils is very common. Our processed foods, fluoride in the water, food antagonists like sugar and phytates, excess nutrient antagonists like iron and zinc and the variety of drugs that we talked about antagonizing chromium.

When you're doing a history with someone, you want to always be careful that you're asking them questions about the things that could be affecting their nutrients and you're not just jumping in to give them extra nutrients but sometimes it's just getting rid of the interfering factors. You won't have to give them all those extra nutrients.

What do you think is the impact of chromium deficiency? Increase in diabetes, increased risk of metabolic syndrome, which is precursor to diabetes, insulin resistance, which is the precursor to metabolic syndrome, the difference between metabolic syndrome and insulin resistance is that in metabolic syndrome, usually the glucose levels are higher but more so, it's also they've developed some of the cardiovascular complications of insulin resistance like elevated cholesterol, elevated triglycerides and high blood pressure.

Blood sugar swings, so it doesn't have to be somebody with overt insulin resistance or diabetes, but those people who can't do more than 2 hours without eating, their sugar is up and down. That can be a chromium deficiency and so many folks who have what they call hypoglycemia, they do well with chromium supplementation and people are sometimes hesitant to give people the chromium supplementation when someone has hypoglycemia, and then somebody who's like a true hypoglycemia versus a reactive type of glycemia, you have to look to see what's going on and what the mechanism is but really, hypoglycemia, reactive hypoglycemia is on the spectrum and the reason that they have the blood sugar lows is that they're overproducing insulin and the insulin is not able to adequately effect the cells but then it suddenly does and it drops the sugars down. You be careful a little bit with people who have hypoglycemia about taking too much chromium but on the other hand, it can be helpful.

Anxiety. People have anxiety, mood swings, fatigue, muscle weaknesses. All of these things can be chromium deficiency and most of it is because of the effect on blood sugar. Sometimes people are on anti-anxiety medications and really what they need is get their blood sugars balanced and get them on some chromium. It would be much easier to give somebody chromium than to have to worry about getting them on all these anxiolytic medications.

What happens in chromium excess? Well, lots of studies that gave daily doses up to 100 micrograms, several months, not found to have any side effects. A little evidence to support concerns that trivalent chromium especially picolinate, may increase DNA damage. There are some studies that say that and it's usually in people with already have adverse problems. If somebody has a kidney problem, they're not able to excrete things appropriately or a liver problem, or somebody who's immune suppressed, but they've done studies with women taking 400 micrograms a day with no evidence of oxidative damage and they're done it by measuring antibodies to oxidized DNA.

Isolated reports of adverse effects. There's very isolated but they are there so you never know when somebody's going to have an adverse effect to anything.

There was kidney failure was reported 5 months after a 6-week course of 600 micrograms a day in the form of chromium polynicotinate. It was a single case but ... and they weren't able to necessarily find the connection but it could by connected. Kidney failure and impaired liver function after 12-2400 micrograms a day for 4-5 months and that's super large dose for super long period of time but like anything, you always have to be careful, you always have to err on the side of caution and especially with super sensitive people, I start with lower doses and increase it up and make sure that they're going to tolerate it.

If you want somebody on 800 micrograms a day of chromium polynicotinate, then what you want to do is go ahead and start them with 200 and start them in a part of the day where they have their worst blood sugar problems, if you know that. Then go to 400 in another meal and 600 so gradually build it up. There was a guy who took really high doses of chromium picotinate after 2 weeks and he reported having reversible but acute kidney failure. There are all these cases but they're very, very rare. If a person has pre-exiting kidney or liver problems, then of course you want to be careful. With anything. With any nutrients, with any herbs, with any drugs.

How do you assess it? You can do a blood test. Blood tests are not necessarily accurate but you can do it. You can do a hair mineral test. You can do functional tests and physical exams so functional tests. You can do a glucose tolerance test which is a functional test. Or you can look to see how is their postprandial glucose before and after. That gives you an idea of their chromium status.

Here's the adequate intake. There's no RDA for it but this is considered the adequate intake and you can see that it is very low, actually. In females, it's only 25 at full blown 31-50 year old versus 35 for males. We're looking at doses of 800 micrograms so that may seem scary or excess, but because people have been in a realm of just constantly bombarding their body with the need for chromium, due to the high levels of insulin, due to the diet, then they need those higher doses to get through that. And then you can gradually drop it down but a lot of these adequate intakes and RDAs don't take into account the environmental stuff and the genetics so there are definitely genetics that would predispose one.

What food sources? Well, GTF, glucose tolerance factor they call it, is an organic form of chromium in brewer’s yeast that has been studied a lot in helping with the insulin receptors. It's also found in broccoli and oats and green beans and tomatoes and romaine lettuce and black pepper and bananas. Bananas better have a lot of it, right? Because they're going to take a lot of insulin to get them in the cells and then beef and turkey breast also have decent amounts of chromium.

Here's a list from the WH Foods. I love ... Their site has a lot of great information, I just took the top 6 from there. You can go in there and see more but these are all considered decent amounts.

If you look at the amount that's in there, broccoli, 1 cup of broccoli has 18.55 so if you go by the RDA being ... or the recommended allowance piece, the amount that you're going to take, all you need is a cup and a half of broccoli and you've made it for female and 2 cups of broccoli and you've made it for a male. These things are pretty high. Barley is not something that I recommend for very many people because it is a gluten grain but I listed it there just to show. Even down to black pepper. I mean rarely you're going to have 2 teaspoons of black pepper, although sometimes maybe you would but maybe a quarter teaspoon. Then everything else is pretty much lower than that so these are your best sources.

There are some herbs that are high in chromium and you may be using some of these herbs with your patients or clients therapeutically for other conditions or you may decide to add some of these ... for, in particular, for getting the chromium. Wild yam. Wild yam is often considered a female herb but it's actually really good for the digestive tract. It's a digestive tonic and calmer and soother. High levels of chromium. Nettle. I love nettle. You can make nettle tea, you can put nettle in your smoothies, you can grind up nettle and put it on anything you want. Catnip. Catnip is one of those herbs that we don't use all that much but it's a good source of chromium. Oat straw. Oat straw is often used as a tonic for female type things and it's also used as a good source of other nutrients. It's used for some of the silica and other nutrients that we need for bone.

Licorice. Although licorice, you do need to be careful about because it definitely can trigger hypertension, even in a person who is not prone to hypertension, if they do too much, speaking from personal experience. Horsetail, although you want to make sure ... it's got a lot of chromium but if you don't heat the horsetail and cook it, you can have inhibitors that may affect the absorption of chromium. Yarrow. Yarrow's a really good one if you're every wounded. It helps to stop the bleeding. You can get a pack of yarrow and put it on a cut, or take in a yarrow tea. It's also used a lot in naturopathic medicine for bringing down fevers. Red clover, which is often used in female kind of preparations as a phytoestrogen and then sarsaparilla, which is a good adrenal tonic.

Some of these you might be using for other purposes and some of them you may just say, ask your client as you're putting together a brew, you might say, "Well, let me give them a combination tea that they could be making or a combination herbal thing or an elixir that contains a bunch of herbs and if chromium is one of the issues, you can add that to their elixir and you can make this very therapeutic, functional and personalized kind of herbal approach for each person.

Supplementation, there's different types that you might see. Trivalent chromium, that's what you want to supplement with. It's either chromium chloride, chromium polynicotinate, chromium picolinate and high chromium yeast. For the insulin, the studies that I've seen, the most studies in the more recent years have been with polynicotinate in terms of blood glucose.

The picolinate, because there was some studies that showed adverse effects at very high levels, I think that's another reason for going with the polynicotinate. But if you've got a person who can't find the polynicotinate or they're in an area where they can't get it, then the picolinate is okay as well. Polynicotinate is actually the chromium compounded with niacin so it's bound to niacin.

Typical range is 50 to 200 but in people who have ... that's what people usually get in but in people who have problems with insulin resistance, we really want to get them in much higher doses. The highest proportion of users of chromium in the studies looked at, who's supplementing with chromium and how much are they using were found in adults over age 50, maybe because they've read about the use of it for insulin problems and we see more and more incidences of Type II diabetes and insulin resistance in the older population. And I would not consider that the older population, but as we get older, I will say. Impaired glucose intolerance in Type II, yeah.

What kind of drug interactions are there? We've mentioned most of it. There's not a lot known about the drug interactions in terms of does chromium adversely affect the drug. We know that certain drugs adversely affect the ability of the body to utilize, absorb and utilize the chromium. Large doses actually of calcium carbonate, which is found in Tums, or magnesium hydroxide containing antacids decrease chromium absorption. The antacids, the things that are the gut kind of drugs that are being given definitely are going to interfere with the chromium so watching out for that if you've got a person's who's ... somebody told them to take Tums for calcium and they're doing it or they're taking Tums because they have what they perceive as high stomach acid, we know we know better ways to handle that. Non-steroidal anti-inflammatory drugs, aspirin and indomethacin, actually were found to increase chromium absorption in rats. That doesn't mean I'm advising people to take these drugs but it's not something you have to worry about if somebody's on NSAIDS for some reason, that's going to affect their glucose tolerance.

Then there's a reference list and that's it for our chromium presentation. I hope that this was enjoyable and that you really got the sense of what the chromium does and how it affects glucose and insulin receptors.