Micronutrients: Selenium

Transcript

Hello and welcome to our micronutrients module on selenium. I am very excited to be here to present this. I'm Dr. Ritamarie Loscalzo and selenium is one of those nutrients that not a lot of people know much about. Those of you who have been here and been on a lot of the case study calls and listen to the cases and been through the thyroid, you know that selenium is super super important for thyroid health. We'll go into the mechanisms and show why and it's important for a lot of other things. It's been showing promising cancer research and a whole bunch of else.

We're going to go through what is selenium, what does it look like, where is it found, what are some of the mechanisms for its action, and then what's some of the research, again, like what are some of the studies showing about using selenium. Let's go.

Before we begin let's make sure that everything we do, everything we share with our clients is not intended to replace a one-on-one relationship with a qualified healthcare professional. We're not giving medical advice. We're giving really good information and education to help empower them to make good choices about what's exactly right for their bodies. If they're on medication, if they're under the care of a doctor, just make sure that they bounce the ideas off their doctor and make sure there's no contraindications for where they're at.

Selenium, it's an essential nutrient, meaning our bodies can't make it and we need it for various functions. It's a micromineral, meaning that it's needed in very small amounts and can be toxic at high levels. Generally not 100% our micronutrients are required in microgram amounts. The major, the more large, the macrominerals, if you want to use that term, are more needed in milligram amounts, so microgram and milligram.

Let's just look at what selenium is and what it does. The picture on the left is from the periodic table and it shows the different rings and electrons. We're not going to go into all that detail. That's stuff we learn in school and quickly forget. You just kind of know to look at the periodic table and you know it's an essential mineral, it's on there, it's an element. It's not a molecule that's made with multiple different things put together like vitamins. The vitamins are combinations of these essential minerals, but the selenium is just a mineral.

It's very, very frequently deficient in our diets, very, very frequent. Our top soil is depleted of it. There's not a lot of foods that are really high in it. It's really essential for a number of enzymes throughout the human body. There's things called selenoproteins.

We'll get into what those are and where those are used. Then there's enzymes like five-prime deiodinase. Five-prime deiodinase is the enzyme that converts T4, the storage form of thyroid hormone into T3, the active form of thyroid hormone.

Selenium is an essential mineral for that conversion. In fact, it's so essential that if we're low in selenium five-prime deiodinase can't work efficiently, but its cousin, five deiodinase can work. Five deiodinase converts T4 to reverse T3 which is like the brakes in the system and free T3 is the accelerator in the system. We'll see how selenium is important right for energy. We don't think of selenium as being important for energy. It's an antioxidant and it's important for thyroid function.

What are we going to cover in this module? We're going to look at why selenium is so important, what are some of the signs and symptoms of its deficiency, what are some of the signs and symptoms of its excess, where is it found in the food supply, when to supplement and what's the best type of selenium to supplement with, and then factors that help or hinder the absorption. That's always an important thing to look at with any nutrient because people may look like they're getting tons of a certain nutrient in their food or in their nutrient supplements and they still show signs of its deficiency.

In Western medicine a lot of times they go, "Well, it can't be that. It must be something else. Don't know what it is but it can't be that," as opposed to looking at absorption. What are they doing to help or hinder the absorption. That goes very commonly done in protein. People look at a person's body, they have signs of protein deficiency, they're getting sick a lot, their skin is kind of hanging off of them, their muscles are weak, but then you look and you say, "But look, they're eating 100 grams of protein a day. It can't be protein deficiency."

I want you to get out of the mode of it can't be an X deficiency or it can't be a Y problem, it can't be a thyroid problem because all the labs look normal. It can't be a deficiency of this nutrient because they get enough in their diet and we have to look at absorption and things that get in the way. Then when should you do lab testing. I will tell you I've never tested somebody for selenium and I've been in practice for 25 years, but we'll look at it.

There's these things called selenoproteins. There have been 25 of them have been identified. Selenocystine is incorporated into an aminoacid sequence, so selenium combined with cystine is incorporated into an aminoacid sequence to make a functional protein. We call them selenoproteins. There's 25 but only half of the 25 have been identified to have metabolic function. Does that mean that the other 25 don't? Absolutely not. It just means that we haven't discovered it yet.

We're constantly learning new things in medicine and in health. Leptin, which is a hormone that's been around for as long as all the rest of them, it's obviously not a new one, was just discovered in the 1990s.

I believe that we just constantly be on top of things and we're always going to find new things. So even if we find a organ or a gland in the body or a hormone it doesn't look like it has much function, we just haven't discovered it yet is my opinion.

Some of them that you might have heard about and some of them you've never heard about. There's glutathione peroxidasis. Those are very important antioxidant enzymes. Thyoredoxine reductase and we'll go through what some of these are. Iodio-thyronine deiodinases, those are the thyroid hormone deiodinases, the five-prime, the five deiodinases.

Deiodinase means what? Well iodine, deiodinase it takes the iodine off, so when you convert from T4 which has four iodines to T3 which has three iodines, we do that because we're taking away one of the iodines, so we need a deiodinase enzyme to do that. Some of the others are selenoprotein P, selenoprotein W, selenophosphate synthetase, methionine R sulfoxide reductase, five KDA selenoprotein also known as SEP15, selenoprotein V and selenoprotein S.

I want you to memorize all these because the test is going to have every single one of these and you have to have these memorized. That's not true, because we just want to get the concepts, the overall where selenium fits in and how we can use it therapeutically. This is stuff for research projects and this is for when, oh, we want to find out how selenium does what it does, oh because it's incorporated into this protein.

The more you understand the structure and the function of the body the easier it's going to be for you to think outside the box when someone presents with a picture that doesn't fit something you've learned and you start to look at, well, what's the enzyme that converts that, what's the protein over there and you go, "Oh wait a minute, I wonder if," and then you come up with new stuff. That's how science discovers connections between symptoms and treatments and specific nutrients or drugs in the case of Western medicine.

So you don't have to memorize all this but as I'm going through it let your mind just go, "Oh, I guess that's why selenium is important for that. Oh, if it does that maybe selenium is important for this." I don't mean to be vague but we'll get more specific as we go through.

There's actually five selenium containing glutathione peroxidasis. It's not just one, there's five. And they work in different parts of the body. There's the classical or cellular level, GPx, glutathione peroxidase. If you ever see that that's glutathione peroxidase. There's plasma or extra cellular GPx. There's phospholipid hydroperoxide GPx. There's gastrointenstinal GPx and olfactory GPx. Does that mean that these are the only GPx-es, glutathione peroxidase? Not necessarily. Maybe we'll discover some others in other tissues of the body as research develops.

Each of them is a distinct selenoprotein. Each of them has a specific structure. They've all got that selenocystine so cystine plus selenium incorporated into their structure to make a different selenoprotein. What they do as a whole, as a group, the glutathione peroxidasis will reduce the damage of reactive oxygen species, free radical damage, specifically hydrogen peroxide and lipid hyper peroxides. It reduces them down to water and alcohol which are just non-toxic that can be eliminated. It does it by coupling the reduction with oxidation of glutathione, so when glutathione gets oxidized they get reduced. That's how they do their thing.

There's a selenoprotein that's in the sperm, in the sperm mitochondria that protects the developing sperm from oxidated damage and later forms of structural protein required by mature sperm. That's just one of the things that they've discovered in here as a seleno.

This is a REDUC cycle, oxidation reduction, oxidation reduction. We start out with reduced glutathione. That means it's ready to be active as an antioxidant. Glutathione comes around through this glutathione peroxidase with selenium and the result is now you have oxidized glutathione and hydrogen peroxide and water. This is the oxidation reaction. We go from reduced glutathione to oxidized. This is the oxidation.

Then it's oxidized. So what do we do to get it back to being reduced so it can work again? Well it combines with riboflavin and an enzyme called glutathione reductase, takes N adenosyl, NADP so niacinamide adenosyl diphosphate, so ATP ADP, ATP is triphosphate, ADP, so it's part of the Krebs cycle actually. It combines with this particular form of riboflavin and that with the glut oxidized we reduce it back to reduced and we have NAPD coming out.

We have these. It's just a cycle that happens all the time as long as you have the appropriate nutrition to do it. You have to have riboflavin to get the oxidized glutathione back to reduced glutathione so it can work again. You have to have selenium in order to get the reduced glutathione and turn it into oxidized and then take a damaging chemical and reduce it down to hydrogen peroxide and water.

This is redox. If you've ever studied chemistry or done a biochemistry class you go through a lot of redox reactions. There's a lot of them. This is just an example, but it's a cycle, but it requires that you have the right nutrition in order for the cycle to go. It's not just enough to have enough glutathione but you need the selenium and the riboflavin to keep this cycle going.

Here's something called thioredoxin reductase. It regenerates. Along with vitamin C you can regenerate this antioxidant. If you look at your picture at the top you see a variety of different chemicals. You see TNF-alpha and you see various chemicals that can be inflammatory, and you see this reaction happening with this thioreductase, KTNF thioreductase.

Reduced thyoredoxine is important for cellular regulation of growth and viability, so it's basically protecting the cells membrane from oxidation, from inflammation, from damage.

We have another one and this is now good old thyroid. We have some iodiothyronine deiodinases. We basically call them the five-prime and five deiodinase to convert from T4 to T3. Okay? T3, all you do is reduce it. The five-prime and the five just tells it where it's taking the iodine from in the structure of the molecule. It's a selenium dependent enzyme. It's not the only thing that can affect the T4 to T3 conversion. You can have plenty of, or your patient can have plenty of, selenium in the system but not be able to convert from T4 to T3 for other reasons. Like, say, they have too much cortisol or they have too much inflammation and cytokines. A lot of things get in the way of that.

So, the three that we've discovered are the Types 1, 2, and 3 of the deiodinases. They activate and inactivate thyroid hormones. So it goes from T4 to T3. Now, there's one deiodinase, well it's not a deiodinase it's an iodinase, that converts back. Selenium is essential for all of this. Selenium is essential for the growth, metabolism, and development as a result of being incorporated into this thyroid process. T3 is the cellular metabolism. Every cell gets it's message of what the metabolic rate should be by having enough T3. So, selenium is critical for this.

Here's one called selenoprotein P, which is found in the plasma. It's associated with the vascular endothelial cells. So that's the cells that line the blood vessels as things go through. The primary function is transport for selenium. So this is basically the transport protein for selenium. You know how we've talked about thyroid and there's thyroid transport proteins. It's the protein that's bound and carries it around until it needs to be used. It also protects the endothelial cells from damage, from various reactive nitrogen species and something called peroxynitrite. So this is an important protein right?

So selenium is important for what? Protecting the blood vessels. So I'm going to try to bottom line some of this technical science down to what is selenium good for in this particular case in selenoprotein P? Protecting the vascular lining. What can that be helpful for? Well, people with heart disease, right? One of the biggest problems with the endothelial lining getting damaged is that then it collects cholesterol and then it collects the calcium and it forms a plaque, and that becomes dangerous in terms of cardiovascular disease: myocardial infarction or stroke.

Here's another one: selenoprotein W. That one's found in muscle and plays a role in muscle metabolism. Six different species of animals have 80% commonality of this selenoprotein. So it's cross-species. Sometimes we see studies and say, "Oh my God," you know, "is that really true in humans?" When there's cross-reactivity and cross-proteins that span species we know that sometimes we can trust those studies. Selenophosphate synthetase: it's required by the genetic code to incorporate selenocysteine into selenoproteins.

In order to make all those selenoproteins we need this enzyme called selenophosphate synthetase. It's a selenium dependent enzyme, that's required in order to incorporate the selenocysteine into the selenoproteins. It's kind of like this incestuous relationship.

Methionine-r-sulfoxide reductase: it's used for the reduction of oxidized methionine residues using the thioredoxin as a reductant. So a reducing agent, in other words, is what reduces and gets us down to the ... back up to the reduced version. There's two forms of it. I don't know that this is all that important but you might see these if you're looking at studies to look at the effectiveness of selenium. So there's the MtX and there's the MfX version of it.

Okay. So 15-kDa selenoprotein is found in mammals in the endoplasmic reticulum. It's inside the cell and has a redux function and also implicated in cancer prevention. So it's part of that redux reaction we looked at earlier. As a result, it's been studied and shown to have some use in cancer prevention, in protecting the cells. Then there's selenoproteins V and S. Selenoprotein V is found in the testes and it's used for spermatogenisis, the creation of sperm. Selenoprotein S is involved in inflammatory and immune responses.

Antioxidant nutrition interaction with selenium. Okay, so, how does selenium interact with other nutrients and other antioxidants? Well, copper and zinc, superoxide dismutase. So selenium is required in and involved in the creation of superoxide dismutase which involves copper and zinc. The enzyme catalase is involved and it uses iron. Vitamin C is important because of the thioredoxin reductase maintains that function by catalyzing it's regeneration. So you've got Vitamin C, right? It's going to be ... Say you have fully reduced Vitamin C. It's like full potency, ready to go, and it gets in your system and starts scavenging around, right? It's broken down. It's no longer a firm antioxidant. You can use the thioredoxin, which is, like we said, a selenium dependent enzyme. It helps to regenerate the Vitamin C back to its fully reduced form.

Then, Vitamin E, which is important, we just looked at, limits the oxidation of lipids. Right? We looked at lipids: the oxidation, the breakdown of those by heat, air, light. There's a lot of things that can do it and it prevents damage from Vitamin D deficiency when you're under oxidated stress because it protects. It works together.

Let's talk about selenium and iodine. Remember the thyroid. Iodine's important for the thyroid, right? So selenium deficiencies can exacerbate the effects of iodine deficiency. Iodine's essential for the synthesis of thyroid hormone. You have to have it because it's an essential part, but if you're selenium deficient you're not going to get enough. The iodine's not going to be as useful. So it's important in decreasing the plasma T4, right? Why? Because it helps to convert it to T3. Selenium increases the deiodinase we talked about and increase the conversion from T4 to T3.

I just want to step in here and say, there's a lot of iodiphobia, fear of iodine, and it's because of implications with Hashimoto's which is autoimmune thyroid. It's said that, "Oh, if you have Hashimoto's you shouldn't take iodine," and a lot of people are going to the extreme of completely avoiding anything with iodine in it. Well, that's kind of a short-sighted approach because we need the iodine to make thyroid hormone. If we completely cut out our supply of iodine, we're not going to make enough thyroid hormone. The problem is if you've got too much iodine and not enough selenium, you're going to end up with an aggravation of an autoimmune thyroid condition.

A lot of the studies that are out and a lot of the people that are writing, "Stay away from iodine if you have Hashimoto's," I think they're just not seeing the full picture. Yes, we need to get the selenium levels up, and then we can supplement with iodine. Iodine excess can exacerbate an autoimmune condition but we need to have the Goldilocks principle involved here. The level needs to be just right.

Let's look at selenium deficiency. Well of course, all of those enzymes and all of those proteins are going to be deficient. A big one is the glutathione peroxidases. Glutathione is a potent antioxidant. It's involved in one of the phase 2 liver detoxification pathways. It's involved in protecting the DNA. So we need to have good action of the glutathione. When you have a selenium deficiency, the glutathione peroxidases don't work very well. Neither do the thioredoxin reductase enzymes and of course they thyroid deiodinases. You can have somebody with a selenium deficiency having some vague symptoms like feeling tired all the time, having their hair fall out, feeling cold all the time, being very sensitive to the environment like not being able to deal with going to a mall where there's a lot of chemical smells or going into a new house where there's outgassing. These liver pathways are not fully acting. Their thyroid is not up to speed. There cells don't have the cellular energy.

Selenium deficiency can result in a lot of different symptoms throughout the body. We don't usually see an isolated selenium deficiency, usually it's in combination with other things. It's hard to induce an isolated selenium deficiency. Generally speaking, it's going to be when people are malnourished, so to speak, or sub-clinically malnourished in other ways. When you are deficient, they're going to be susceptible to other physiologic stresses. So if you have somebody you're working with that says, "You know, I'm just ... I-I get every cold that goes around," or "I just can't tolerate it when I walk into a room and somebody's wearing perfume," "I have to get my sleep or else I-I'm a basket case for the next three days," may be a selenium deficiency.

Now, the cool part about selenium, unlike most other nutrients, is that you can supplement very easily from food. It's not always going to be effective if they have impaired fat digestion but Brazil nuts are an excellent source of selenium. One Brazil nut has the RDA for selenium, at 100, or more than the RDA, at 100 micrograms.

Even the amounts of selenium that have been found to be effective in things like Hashimoto's and thyroid disease, it's something like 200 to 400, which is 2 to 4 Brazil nuts: not a hard thing to do. It's not like having to eat a 1/2 a cup like other nutrients if you wanted to get 100% or 400% the RDA, you'd be eating that food all day. So it's very cool in that way but people who have impaired fat digestion may not be taking it in.

So who's at risk? Well people who are chronically ill and they receive TPN, which is total parenteral nutrition. They're giving all their nutrition through an IV bag and if they don't add selenium for long periods of time of course they're going to become selenium deficient. People who've had a large portion of the small intestine surgically removed. There's people who've developed cancers, or Crohn's, or other kind of disease, and they just lop out part of the small intestine. People who have had gastric bypass surgery, where they've had the full-blown ... you bypass the stomach and the duodenum and food goes right into the intestine. You can have a risk of selenium deficiency. In those cases, I recommend liquid selenium supplements that are quick and easy to absorb, that can even be absorbed somewhat in the mouth.

Anybody who has severe erosion of their intestinal tract like Crohn's disease, anything that causes mal-absorption, like severe leaky gut, these kind of people are at risk of selenium deficiency. Folks who don't have good stomach acid are going to be at risk for selenium deficiency because we need to have good stomach acid to cleave the selenium off of it's carriers. Then whenever people are on special diets like PKU diets, they're often low in selenium. Anytime somebody's on a specialized diet where they're removing very large percentage of their food groups, they run the risk of selenium deficiency.

Here's a particular disease that's related to deficiency. It's called Kashin-Beck disease and it's characterized by the degeneration of articular cartilage between the joints. So, basically, a kind of osteoarthritis. It's associated with selenium deficient status, generally affects children somewhere between the ages of 5 and 13, and severe forms can result in joint deformities, and dwarfism. It actually thwarts the growth of the bones. So that's important thing to know, that if you've got somebody who's got a child who's not growing, who's having a lot of pains ... you generally don't see an osteoarthritis in a child, it might be a selenium deficiency and this kind of a disease.

Immune function. Selenium stimulates the immune function. Two hundred micrograms a day of sodium selenite, which is one of the forms, has been found to show enhanced immune cell response to foreign antigens. What does that mean? So when you're taking, or have somebody taking, 200 micrograms a day, if you measure their immune response you're going to see that when antigens get in, antigens being the bad guys, the foreign invaders, they get in, you're going to see an enhanced response in people that do 200 micrograms a day versus no supplementation. It also plays a role in the expression of cell-signaling molecules.

Cytokines, we've talked about them before. They are inflammatory chemicals and they rev up the inflammatory engine and they signal. They signal cells to do things. They are big part of the immune system. A big part of an aberrant immune system an immune system that's not working real well is that the cytokines build up, you have too many cytokines and it cost all kinds of havoc. One thing in particular is when you have excess cytokines it damages your thyroid receptors.

People with excess cytokines are having inflammatory responses and thyroid problems and they don't necessarily have thyroid problems in the blood. They have symptoms of thyroid without having the thyroid actually showing up as out of balance in the blood. IV sodium selenite is used in alternative cancer centers. I know I've had conversations with Dr. Tom Lodi, he runs a center out in Arizona. He uses it, he alternates it. He say you can't use sodium selenite along with vitamin C. You have to alternate them so he'll have people come in for one day their IVs are sodium selenite.

Another day their vitamin C. He's getting really, really good results. Selenium deficiency can lead to viral infection. Again, if you had somebody who's always telling you I get every cold that goes around, I've got some viral stuff. Maybe they have hep C, maybe they have Epstein–Barr virus. The deficiency will actually cause a further degeneration and progression of those infections, worsening of those infections. Oxidative stress induces changes in the expression of some of the viral genes.

When you got a lot of oxidative damage, a lot of free radicals floating around, a lot of oxidized heated fats in the system, it can actually change viral gene expression. Cellular glutathione peroxidase which we said a selenium dependent enzyme protects against the inflammation in the heart, myocarditis that can result from gene alterations. It can actually change the genes of a previously benign virus but it turns it into a potent and damaging virus that can cause myocarditis.

Then, we have the decrease activity of glutathione peroxidase. What does that do? It increases the oxidated damage and the likelihood of mutations in the viral genome. What about selenium in cancer? At high levels, selenium reduces the incidents of cancer. It significantly reduces the tumor incidence and the methylated forms of selenium are the active species against tumors. Now, if you have somebody who has methylation issues, has a difficult time creating methyl groups. We talked more about genes.

We'll go into that in great detail but methylated forms of selenium are the most active but people who have problems with methyl and methylation again they need to have some supplementation of methyl groups in order to optimize the usefulness of the selenium. People with low plasma selenium concentrations have been found to have risk of liver cancer and an increase risk of lung cancer. When you're low in dietary selenium there have been studies that have shown that there's increase risk of prostate cancer.

Again, the IV selenium sodium selenite is used just part of alternative cancer treatment so that is like a case for how selenium might be useful in cancer prevention. The rich antioxidant capacity there or the support for those antioxidant enzymes the glutathione peroxidase. Selenium deficiency can be a contributing factor in cardiovascular disease. Remember, we talked earlier about the specific selenium dependent proteins that are lining the cell walls, the endothelial lining of the blood vessels.

If you have increased lipid peroxidation or damage to the lipid cell linings in the endothelial lining, the blood vessel lining you have more of a risk of damage from various and sundry toxins that come along and trans that to one of those toxins that aggravate that cell wall. Really need to have your selenium intact to be able to deal with that and most people don't get enough selenium and they are under a lot of oxidative stress. Type two diabetes. Insufficient dietary selenium can interfere with your body's ability to effectively use insulin. We have people who are eating a lot of sugar and processed foods.

They produce a lot of insulin and then they don't have enough selenium, it impairs the absorption and the utilization of the insulin to get the sugar out of the blood which leads to insulin resistance and a potential for type two diabetes. Supplementation decreases the risk. That's one of the things that you might want to be looking at with somebody who has a risk of diabetes or got insulin resistance. There have been studies done on selenium deficiency in relation to HIV and AIDS. There's an interaction with the HIV which what? It's a virus.

Remember we talked in the last couple of slides ago about the viral changes and the changes to the genome and the genes of the viruses. There's some specific if you look at declining levels of selenium in HIV infected people it's a sensitive marker to how badly their progressing downward. Right? You say, "This person is really low in selenium. Their HIV/AIDS infection is getting worse." When you increase the levels of the selenium it decreases that decline. How does it do it? How does selenium affect viral infections? How does it affect HIV in particular?

We know that HIV infections are related to problems with the T helper cells. The selenium can actually enhance and support the function of this T cells and it modifies the T cells production of cytokines. Remember we talked about cytokines being potent inflammatory markers. Potent inflammatory chemicals. The selenium can reduce the production of the cytokines by T cells. In an HIV infection, there's oxidative stress present. It's going to favor replication of the virus which is going to make the situation worse. It can activate specific transcription pathways.

Selenium can decrease that oxidative stress and therefore slow down those transcriptions which is going to decrease the replication of the HIV virus. HIV may be capable of incorporating host selenium into viral selenoproteins. They have glutathione peroxidase activity. If you give this selenium, the HIV virus can actually take that and put it into this proteins that have an effect on glutathione peroxidase which is going to protect.

What happens with excessive selenium? Okay. It's rare but here's the thing, if you've got somebody who has garlic breath even though they may not be eating garlic, nausea, diarrhea, skin rashes, irritability, metallic taste in the mouth, brittle hair or loss of hair, discolored teeth and nervous system problem.

How much do we need? Not much, okay but what's therapeutically applicable and what's been down to the therapeutically useful is much larger doses. You can see that the highest need is in pregnancy and lactation. Lactation above all, 70 micro grams not very much considering one Brazil nut has a 100 micro grams. Right? It varies across the age but not very much. It's under a 100. In people, the highest age range is between 14 and 50 it's 55 milligrams. Actually all of those are the same. How do we get it? Where is it found? In the animal base side it's found in various fishes, tuna, halibut, sardines and shrimp and also in ham.

On the plant side, Brazil nuts contain a 100 micro grams in each nut. It's also found in wild mushrooms especially porcino and pine mushrooms. Also found in chaga and reishi powders. One of my favorite things to put in into an antioxidant beverage and I put them in my thyroid elixirs. Wonder why? Also found in chia seeds and mustard seeds. There's a lot of good sources of selenium in the diet. There's no way, it's really easy to get selenium in the diet. The interesting thing is often times the therapeutic amounts of nutrients that are required to get specific effects you can't get it from food necessarily.

With selenium it's pretty darn easy to get it in food. The issue is you got to be just careful that if you're working with somebody who has impaired digestion, impaired fat digestion is going to impair the amount of selenium they are going to pull out of their Brazil nuts. If they have in general impaired stomach acid, mushrooms are high in protein. Chia seeds have a fair amount of protein so if they are not breaking down the food because of digestive complaints then you're going to have to do some supplementation temporarily while you work on the digestion.

There's different types of supplements not all supplements are created equal. We have sodium selenate and sodium selenite. These are inorganic forms. The selenate is almost completely absorbed pretty easy to absorb. Significant amounts is excreted in the urine before it can be incorporated into proteins. You can go by urinary excretions to say we have too much. You've got to exceed that threshold. The selenite is only 50% absorbed but it's better retained than the selenate.

That's why they use it therapeutically in cancer IVs because even only 50% is absorbed much of it is taken in and I think with the IV it's going straight in but with it taken orally you're going to get about 50% less absorption. Common one is selenomethionine, that's the organic found and that form and that's what's found in natural foods. It's about 90% absorbed so that's pretty darn good isn't it?

You've got selenium enriched yeast which mainly provides selenomethionine. You need to be aware that some of the forms of selenium yeast contain yeast plus inorganic forms of selenium.

It may not be what it looks like. Both forms can be metabolized to selenocysteine and remember that was the amino acid cysteine with selenium that's incorporated into to make those seleno proteins and the enzymes. What about drugs? Are there drug interactions? Sure. Anticonvulsant medication, valproic acid has been down to decrease selenium. If you know your client is on a medication like that, what do you do? You make sure they get extra selenium. Then, when you give supplemental sodium selenite it actually decreases the toxicity of some of the antibiotics especially nitrofurantoin and an herbicide paraquat.

It really it interacts in a positive way with some of those drugs. How do you assess for selenium? Signs and symptoms. You look for signs and symptoms of selenium deficiency and it can be vague and selenium deficiency signs overlap with some of the other signs. You look at family history and health history. Do they have a history of thyroid disease? Do they have a history of cardiovascular disease? You look at their genes. You look to see do they have any glutathione impaired genes. Do they have any genes that would affect this? You can do a taste test.

There's liquid minerals that a company called Body Bio makes where you can swish around the selenium in your mouth and see what it taste like. If it taste foul, generally you don't need it. If it taste yummy, generally you do. There's all kinds of things in between. We've done demos of this at our retreat. We have the organic test and that should be Organix or organic acids. Organix is a particular company. It's an organic acids test, Organix is the name of one of them. Basically that is a test and it's testing bio products of metabolic reaction.

You're testing all this different chemicals that will give you an idea, these acids in the urine actually that will give you an idea of which pathways may be blocked. If you have high levels of certain organic acid it can indicate the deficiency of some of the things in the path ways before that. It's a very nice test because instead of doing just a full panel of how much do you have of selenium. How much do you have of calcium in your blood or in your urine or whatever, tissue. It's actually mentioning, it's actually measuring the functionality.

I'll give you an example. Vitamin B12, doing a vitamin B12 serum test is pretty close to useless. It's pretty close to useless. The forum you don't know if it's metabolically active, you don't know if you have the ability to methylate but if you do something called methylmalonic acid it's an organic acid that builds up in the absence of vitamin B12 and it is considered a gold standard for vitamin B12. That's measured as part of this organic acids test. The organic acid test also measures not just blood levels in the sample but functional levels of a variety of nutrients.

It's a really nice test and it can definitely tell you if there's a selenium or there are signs of a selenium deficiency. Then, you can do toxic and essential elements. You can do a urine test for toxic and essential element. You can do a hair analysis. You can also do a stool test so we're looking to see what the levels are. The best of course is to do all the compartments and compare and see if there's consistency. You've learned about selenium, you've learned how it works.

You're probably way over the top in the bio chemistry diagrams and all that but it gives you an overview of how it works. It gives you an idea of how it's important not just that it's important but why it's important. I think that's an important thing. We've looked at deficiency signs, we've looked at excess signs and we looked at how do you determine if this person has adequate selenium. That's the end of our selenium presentation.