



EVERYDAY IMMUNE RESILIENCE

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Hi everyone. Thank you for joining me today. Today's topic is going to be on glutathione. Glutathione is something that is getting a lot of attention recently, but it's also one of the most important nutraceuticals that many people who work with chronic patients have been using for many, many years. The key thing about glutathione is it's basically the key antioxidant in the body. Glutathione is found in all different tissues in the body and glutathione is found in all different cells in the body.

One of the key things about glutathione is that it really helps prevent against free radical production and oxidative stress. So, what I'd like to do before we take questions is just to give you some fundamental background of glutathione and tell you what was published about it before the pandemic with COVID-19 and then talk about some of the recent papers that have come out with COVID-19 and then talk about the applications and being a little bit critical of what's been published and so forth. And what you need to know about it and so forth to kind of help with the confusion.

Now for the key thing, the main thing you want to really understand about glutathione is that it is something that our body makes all throughout our cells and our tissues. Glutathione has many functions. One of the main functions is it's an antioxidant, so it protects against free radicals. Free radicals destroys tissues when we have an inflammatory response.

The other key thing about glutathione is that it is an important immune modulator. So the most important cells for autoimmunity are regulatory T-cells. And regulatory T-cells modulate the expression of autoimmune diseases, how active it is, if it goes into relapse or remission. And the regulatory T-cells of the immune system have lots of receptors for glutathione.

So glutathione has a direct effect on these regulatory T-cells. And therefore, not only is it an antioxidant, but it's also a very powerful immune modulator. The other key thing that glutathione does is that glutathione is involved with what is called phase II biotransformation. And biotransformation is the ability to take compounds that are toxic or pollutant substances and then convert them into an end product that the body can eliminate.

So we do that through what's called the phase I and phase II pathway in the liver. We also have enzymes in the microbiome that do that. So we get exposed to certain pollutants like in air pollution or pollutants in our environment. Glutathione plays a role for some substances to help clear that out of our body.

So if you can take a big step back and take a glutathione, glutathione does a lot of really amazing things. It's a very powerful antioxidant, it supports the respiratory immune cells and helps with biotransformation pathways.

And what they've done with the studies is they've found that glutathione is a key factor in causing neurodegeneration. When levels get depleted, glutathione is depleted with all types of inflammatory conditions.

So whether it's an upper respiratory infection or a gastrointestinal infection or whether it's oxidative stress from radiation, whether it is an autoimmune disease, the glutathione levels get depleted when there's a chronic inflammatory state, and that's pretty much the role of antioxidants.

So when we get chronic levels of inflammation, the inflammation starts to create free radicals and free radicals destroy our tissues. And one of the things that glutathione does is it basically helps with electron transfers, so it neutralizes the free radical so it doesn't destroy tissues.

Now the other interesting things about glutathione are that glutathione levels — the production of the enzymes that are used to make glutathione — the total levels of glutathione we have go down by every decade. So the glutathione levels we have when we are 10 are different levels than at 20 and 30, and 40 and 50. So as we get older our glutathione levels tend to go down as with most antioxidant systems.

Now there are some really interesting things about glutathione. So I'll talk to you about what foods can raise glutathione. I'll talk to you about what nutraceuticals have been shown to raise glutathione. But the key thing with glutathione before we go any further is there's some lifestyle factors that have a huge impact on glutathione.

The more inflamed you are, the more glutathione depletion you'll have. That's just the basic concept. So if you're dealing with an inflammatory disease, you're going to have glutathione depletion to some degree. If you're dealing with infection, you're going to have some glutathione depletion to some degree. If you have an inflammatory diet, you're going to have some glutathione depletion to some degree.

So we all have different states of inflammation or antioxidant — some degree of inflammation and some degree of antioxidant production. We want to balance those two out. Now if you get a chance to check out my website Dr. K News, drknews.com I've written articles on glutathione and I have something called an Immune Resilience Program, which is a free program and it talks about things you can do from diet and lifestyle to make an impact in glutathione in your immune system.

And then there I talk about how important sleep is to immune function and the reasons why. But there's also research that shows that your antioxidant systems, your glutathione levels, your glutathione enzyme producing systems become dysfunctional when you don't get enough sleep. So sleep is critical in monitoring the means and different ways, which we talk about in the Immune Resilience Program if you want to check that out.

But one of the other things is that sleep has an impact on glutathione and so does exercise, which is another key factor when we talk about strategies for immune resilience. So when you

exercise, you also increase your antioxidants producing systems. So sleep and exercise are like one of the two main ways to naturally raise your glutathione.

So if you take a person who's really inflamed, has lots of inflammation, is around air pollution or smokes a lot, and they don't exercise, they don't sleep well, and then they have a diet that's low in vegetables, especially vegetables that are high in sulfur or vegetables that help produce precursors for glutathione — so basically garlic, onion broccoli, cabbage, kale — those are all the things that help raise glutathione levels from diet.

So if you take someone on a fast food diet and they're sedentary and don't sleep well, then their glutathione levels can be way down. Now you add an infection on top of that or pollution on top of that, or environmental toxins on top of that, you get a person who's really in bad shape.

Now, one of the biggest clues that someone may actually have antioxidant depletion that we see clinically is a person, for example, that just is always inflamed, their body always hurts. They're always tired. They're always run down. Those are states of chronic inflammation.

And one of the other key things that is a major red flag is if they exercise, they just don't recover very well. There's some people who exercise and they just crash for days and days and days. For some people, just a brisk walk, for other people it could just be a 20 minute exercise but they actually feel dramatically worse.

Now remember what happens in exercise is you actually produce free radicals at a much higher level in the first hour or two when you're exercising or afterwards, and then you get this massive activation of antioxidant-producing enzymes like glutathione to counteract that exercise induced inflammation, which lasts for many hours afterwards.

So even though you get some free radicals from this exercise, your anti-inflammatory system and antioxidants comes in and really quenches that response. This is why exercise is so beneficial to raise your glutathione levels and your antioxidants.

However, if you don't have the ability to activate it because you don't have the precursors and mechanisms to allow that to happen, then you can typically crash. So those are the key things with glutathione.

Now, glutathione, I've been using it for many years in clinical practice myself and many clinical nutritionists, functional medicine practitioners that practice an evidence-based model — because glutathione is such a... there's such good research on its ability to work as an antioxidant and quench inflammation and it's so important for things like autoimmunity and so forth.

Now, there were some interesting studies about glutathione published. I'll just summarize it to you really quickly. First of all, they've done studies where they put a pathogen in the gut barrier and they find out that the gut barrier doesn't actually break down until glutathione levels are depleted.

So we've all heard of things like leaky gut or intestinal permeability. When we get something that triggers an inflammatory response against our gut, whether it's gluten for a celiac disease person or an infection or pathogen, the gut barrier doesn't actually break down until glutathione levels get depleted. They've done similar things with glutens and the pulmonary system of the lungs. So those are things that could be a factor with it.

Let me turn my volume up. I think I heard my volume is not so good. Let me check something here. Okay. So maybe that helps with the sound.

So the other key thing with glutathione is that glutathione levels have been shown to break down with not only the gut barrier, but the lung barrier, and also the blood-brain barrier.

So whether you have a free radical, a chemical, a pathogen, it's just systemic inflammation. The barrier system doesn't break down until glutathione levels are depleted.

Now this is important because there have been some studies now where they've looked at the clusters of significant outbreaks of COVID-19, and they have mapped them out with also the areas where there's a high degree of air pollution. And other studies in the past have shown that air pollution does significantly deplete glutathione.

So there's some inferences and there's some theories where, areas where there's high amounts of pollution, then you can deplete glutathione levels that can open up the barriers. And that's one of the pathophysiology of coronavirus. It gets to be more extreme. So as you guys know, the SARS-COV-2 viral organism binds to angiotensin receptors throughout the body and it's found in the lungs too. And then the lungs break down and then this inflammatory cascade takes place.

So one of the theories out there in the nutritional world and preventive medicine world is that people that already have reduced glutathione, which are people with preexisting conditions like diabetes or people that smoke, people that have inflammatory conditions, people that are recovering from a pregnancy, it's not just that their immune system is weak but their glutathione is really depleted. And that in combination with areas that have air pollution, and then the infection, can be something that really orchestrates significant risk and responses.

Now as far as what's been published on glutathione, there hasn't been anything dramatic published on glutathione in the literature. If you go to clinicaltrials.gov where people register clinical trials before they do them, there's a non-randomized study with about 86 participants where they're going to do IV N-acetyl cysteine to raise glutathione with COVID-19 patients that are severe, but that study hasn't been published.

Besides that, there's just been a case report with two patients published where they showed people that have severe COVID-19 symptoms if they're given compounds like N-acetyl cysteine to raise their glutathione, their symptoms seem to improve. And there was a Russian researcher that did a really great review and he published a paper where he theorized that people that have COVID-19 may become severe because of glutathione depletion. He wrote an excellent paper on that.

And he reviewed the reasons and mechanisms behind it and he had given some examples of some patients that went from minor symptoms to severe as your glutathione levels were depleted, but it was just a few sample subjects. And that's kind of it. So we don't have these major breakthrough on research on glutathione being done.

So it's not necessarily there yet as far as the evidence goes. But here's the thing with glutathione. Glutathione is... I'm not sure what's going on with my volume. Glutathione is absolutely a...

Okay. I don't know. My mic's on as loud as it can be. [crosstalk 00:12:43] So I'll try to speak louder.

Glutathione is one of these things were it really is an important compound and it may have a lot of promise for patients to be preventative for antioxidant health status prevention. So that's the basic thing. Now, the other key thing about glutathione is... Let me see if I can get my volume better here.

Okay, now people can hear. I can hear [crosstalk 00:13:13]

Oh. People can hear?

Now. Great.

Okay, great.

I think [inaudible 00:13:18]

Thank you. So the other key thing about glutathione is that — how do you raise it? Some people question, "What do I do? How do I raise it?" So there's lots of things that can be used to raise glutathione and basically break them down into nutrients, sulfur amino acids, botanicals and so forth.

So the main nutrients that have some benefit on raising glutathione are selenium and vitamin C, there's micronutrients. And then there's botanicals like cordyceps is a botanical that's been shown to raise glutathione levels. gotu kola has been shown to raise glutathione levels. There's a botanical called milk thistle has been shown to raise glutathione levels.

And then sulfoamino acids like alpha-lipoic acid and N-acetyl cysteine have also been shown to raise glutathione levels. Now, whey protein has been shown to raise glutathione levels too, but whey protein is really inflammatory for many people, so I really don't recommend that.

And if you look at all the things that have the biggest impact and you look at cost and you're trying to figure out, "If I want to take one thing to raise my glutathione levels, what's the easiest and fastest way to do it? And cheapest way to do it." And that would be N-acetyl cysteine. So you can find N-acetyl cysteine in pretty much every health food store and dosage of 1,500 milligrams would be a good dose and that would raise glutathione levels. Some people take more, but 1500 milligrams, you're going to have some impact on raising glutathione levels. So if you're trying to figure out what to use to raise glutathione that's one way.

Now there are glutathione supplements available also. Glutathione is a tripeptide amino acid. It's glutamic acid, cysteine and glycine, but the glutamic acid and glycine are very easy for the body to make naturally. What they really need is that sulfur, that N-acetyl cysteine. And that's also why it's so important to have diets very high in sulfur precursors like we said earlier. Garlic, onions, cauliflower, cabbage, kale, those things can all be supportive to raise levels. And then sleep and exercise are also really critical.

So actual glutathione itself is very hard to absorb. So typically when you just take N-acetyl cysteine, you get the precursor you really need to make that building block of glutathione. When you actually buy glutathione as a supplement, it's much more expensive than N-acetyl cysteine. And eventually what's going to happen is that glutathione you take is going to be broken down to glutamic acid, glycine and cysteine, and then you can use the cysteine to build it.

Now there's another version of glutathione called acetyl glutathione which you can use. Acetyl glutathione has been shown to absorb through the gut. And even better, there's been a form of glutathione called liposomal glutathione which is a liquid form of glutathione that can go through the gut. So for me personally, if I'm going to actually use glutathione, I like to use the liposomal acetyl glutathione. And that seems to be a really good way to absorb into the system and really work.

If you don't have that available to you the liposomal acetyl glutathione because not many manufacturers make that, then I would just use NAC. But the liposomal acetyl glutathione is one of the very best ways to do it. And then number two would be N-acetyl cysteine. My wife is cracking up at me.

I'm laughing at comments.

Oh she's... Okay. Anyways those are the ways to raise glutathione.

Now I can tell you in our family we take glutathione every single morning. Every day my daughter and my wife — my daughter was basically able to digest food. She was taking a liquid Trizomal Glutathione because it's such beneficial benefits.

So what I can only tell you is that we don't have any direct research published anywhere in the literature where they have shown COVID-19 can be impacted by glutathione other than a couple of case reports where some people have some theories and it's not sufficient evidence. The clinical trial that's going to be done will be interesting, but they're doing six grams of N-acetylcysteine IV so that might not be practical for information that could be generalizable to the whole population.

But at the end of the day it's a safe way, something to consider. And it's one of the ways, some of the mechanisms that can explain why there are some subgroups that are potentially having significant symptoms. So I think there's some validity in that too. If I were to look at the evidence and the mechanism involved, I think one of the major reasons where patients that have a viral infection tend to progress into severe state and some don't.

One of the mechanisms may be for some people, but not for everyone, because I think there's some genotypes that may respond to the virus differently, is whether they have enough reserve of glutathione to protect their lung barriers, whether they have enough glutathione to prevent what's called a cytokine storm, the inflammatory cascade, and whether they have enough glutathione to modulate their immune system with those T-reg cell activations. So those are all the best things there.

Okay. So I can try to take some questions. Those are the key summary things that I was hoping at least to cover as a baseline.

Lisa says, "**When's the best time to take glutathione?**"

When's the best time to take glutathione? Any time. So glutathione is one of those things where you want to get into your system. With antioxidants sometimes the more oxidative stress you produce for yourself the more demands you have.

So if you have an inflammatory response because you react to certain foods, if you exercise a lot you may want to take more, some people can make double doses, but for the most part simply you can just take it anytime throughout the day. There hasn't been any real research published where it shows take in the morning and take in the afternoon has any better effect than any other time. Okay? Next question.

Yeah. Okay. Micky, "**Can you take selenium, vitamin C and glutathione? Can you take too much?**"

Can you take selenium, vitamin C and glutathione together?

Can you take too much?

Yes, you can. So if you take too much vitamin C when you start getting into the 5,000 milligrams or more, you can end up with watery bowel movements and diarrhea. So the key thing with vitamin C is there's a point where it's going to really increase your bowel activity. So there were some people that with vitamin Cs they go up to bowel tolerance and then they back off.

So for people it's usually around the 4,000 to 5,000 milligrams. If you take more than that, then you may have that adverse reaction.

Selenium... people can get selenium overload, but the upper safe limit is 400 micrograms per day as an acceptable standard, so you want to keep it below there.

And then glutathione there's no significant side effects with taking too much glutathione, because it's just a tripeptide amino acids found throughout the body. You could just end up spending a lot of money with overdosing on those three ingredients. Same with N-acetyl cysteine.

N-acetyl cysteine is an abundant sulfoamino acid found in your body. You can take 5,000 or more milligrams of it and not have any issues, even though with 1,500 milligrams you can actually see significant change in glutathione levels.

Okay. Heidi, **"For someone with acid reflux, what is the best form? I have IBS/SIBO and recently started having acid reflux."**

Well, your acid reflux and your... So the question is, signs of inflammatory bowel disease and acid reflux, what's the best form to take glutathione? Well, I mean at the end of the day, just the fact you have an inflammatory bowel condition, you're going to deplete glutathione as soon as you take it because it's going to be used to quench the inflammation in your gut.

So the key thing with glutathione is it's not like we know a disease specific amount we should take. It all has to do with the fire. So think of, if you have an inflammatory condition the inflammation is like fire throughout a forest. How much water does it take to put out the fire? For some people they need to take more than other people.

Now the other key thing with glutathione not everyone has a noticeable difference when they take it, but the ones that do, it's a clinical red flag whenever we see that — that they really need an antioxidant protection. So some people will take glutathione and go, "Wow, I feel a lot better and I think I just have more energy all of a sudden." And it's pretty quick. It's within the first 20, 30 minutes.

And for them then we're like, "Well, then dose up." Then they dose up and go to a higher dose and then they find that maybe it's not 1,500 milligrams, it's 3,000 where they really feel the best. But when they take about 4,000, it's not really different than 3,000. So that's going to be the dose for example for their N-acetyl cysteine.

And then there's a majority of people that are already pretty healthy and they have pretty good antioxidant systems. And if they take glutathione, they just go, "I don't notice anything." And that's okay. In our family, we take glutathione all the time. It's not like we get a big buzz or feeling from taking glutathione or N-acetyl cysteine. But people that have lots of inflammation or chronic diseases sometimes notice a difference.

So how you respond to glutathione can give you a clue. So if you have an inflammatory bowel condition and so forth you may want to play with the doses. You may need more than 1500 milligrams to have some type of impact for you. And some people with significant inflammation, we have them go on N-acetyl cysteine and vitamin C and selenium and milk thistle. We use a combination of all those things and then acetyl glutathione or Trizomal Glutathione all at the same time to try to calm down and inflammatory cascade.

Okay. From Allen, **"Can you talk about intermuscular shots of glutathione. Some people are getting from their doctors. Is that better than oral?"**

So the other thing that's... The question is, can I talk about intramuscular shots with glutathione? Okay. So there's different ways to take glutathione. You can take oral supplements like we talked about to raise actual glutathione, but preferably in a liposomal form or in a N-Acetyl glutathione form or things that raise glutathione like N-acetyl cysteine, Alpha-Lipoic acid, milk thistle, gotu kola, cordyceps, and then nutrients like vitamin C, selenium.

Those are all the things that help your body raise glutathione levels. Or you can get IV glutathione and typically people will use the drip bag and they can IV glutathione or you can get an intramuscular injection, whether you do IV or intramuscular injection. What's going to happen in that state is going to be a huge burst of glutathione into your system, but it's going to not last for a long period of time.

For people that have significant acute inflammatory reactions, IV would probably be the best approach. So if someone is in a cytokine storm from an inflammatory cascade, that would be a good way to address that. The clinical trial that they're doing is they're doing IV and IV versus intramuscular is still going to get glutathione right into the bloodstream.

So it doesn't matter how, it just depends on how you want to do it. IV glutathione is... intramuscular is just a push. So it's done really quickly. IV glutathione in a drip bag, people sit in a chair for 45 minutes with glutathione mixed in a saline bag and just they'll have to... The treatment can last 45 minutes determined by how fast the drip is going.

So even if people do a drip or intramuscular injection, oral strategies to raise glutathione work extremely well. They're just not getting that huge load that's taking place.

Okay. So Sean says, "**In that vein, does IV glutathione down-regulate the body's natural production of glutathione? Does it lead to issues long-term or is it safe and effective to do it regularly?**"

So the other question that comes up regularly is..

There's no significant finding that taking glutathione or taking precursor glutathione are going to deplete your own natural production of glutathione. That just doesn't happen. So your body is going to make glutathione as it needs it, but if it's circulating around in your system, it's just fine.

Now the key thing with actual glutathione production is that you have the precursor fuel. And the key precursor is really sulfur — N-acetyl cysteine or sulfur foods in your diet in combination with sleep, because you have to activate your glutathione enzyme system to work properly in combination with physical activity, especially exercise because that boosts up your anti-oxidants producing systems. The combination of those things are really critical. If you take exogenous glutathione you're not going to shut down glutathione producing system. That just doesn't happen.

Okay. From Nancy, "**Can you talk about the two forms of NAC.**"

The two forms of NAC. They're both going to work to raise glutathione. Any form of NAC you take is going to have an impact on raising glutathione. And there's just not enough evidence that one is really better than the other so just take it.

Any top brands you like? Rob is asking, "**What's your top brand like?**"

I really don't want to talk about specific brand names. I really want to try to keep these talks commercial free. So I really don't want — I just want to talk about the research, if you guys don't mind.

Nebulizing glutathione. People would like [crosstalk 00:27:05]

Okay. Nebulizing glutathione. Great. Right. So that's another way to take glutathione I forgot to mention. Nebulizing glutathione is where you use a nebulizer and you put glutathione in and breathe it in that way. And that may have some promise with some upper respiratory types of infection because you can really breathe in the glutathione.

For some people, the sulfur irritates their lungs and they actually get coughing and feel awful when they take it. So that's the only concern with that.

So I mean with glutathione you can take it through the nebulizer, you can have it delivered IV, you can have it delivered intramuscularly. You can induce... they even have suppositories, vaginal and anal suppositories to raise glutathione.

And then you can take it with supplements, the actual compound or the nutrients in precursors, all different ways to raise glutathione. But for most people, the easiest way would be something like N-acetyl cysteine, vitamin C, selenium, gotu kola, milk thistle, or something like a liposomal glutathione. Those are the best ways to do it for most people that don't have access to IV, or intramuscular, or to a nebulizer.

Okay. A lot of people are asking, "**Can we check glutathione levels in the blood?**"

Can you check glutathione levels in the blood? You can check glutathione levels in the blood, but it is dynamic. So it can change and vary from day to day. So it's not like one of these things where you measure glutathione and it's that way for you all the time.

So there are labs where they look at something called the ratio between what's called oxidized glutathione and reduced glutathione. And they can look at those ratios and give a clue of what your glutathione levels are. So those tests have been used in some research circles. They're quite expensive and they kind of fluctuate and it just doesn't seem to make much of a difference when you look at those tests. Also, when you do measure those tests, what you'll also find is it's not the amount of glutathione that changes that.

So if you have a person who's got an abnormal glutathione ratio on lab blood work, [...] oxidized reduced indicating the glutathione status, getting more and more glutathione doesn't necessarily change that. What actually changes that is reducing the overall inflammatory load. So realize that glutathione is just fighting the free radical oxidative stress inflammatory response.

But what's causing that is also one of the key factors of why it's being depleted. So for example, you could have someone who has gluten sensitivity and they keep eating gluten and that causes chronic inflammation for them. Well, that chronic inflammation is going to deplete their glutathione levels.

So dosing with glutathione may not change their serum levels. But once they actually get off gluten, boom right away, those levels improve dramatically. So what we find with glutathione biomarkers is that you don't see much change specifically with supplementation, you see change when you reduce the inflammatory load. Okay. Next question.

Can you spell N-acetyl cysteine.

N-A-C-E-T-Y-L C-Y-S-T-E-I-N-E.

Okay. Amy says, "**You mentioned liposomal-**" — Oh, by the way, you can just type in NAC nutrient and you'll see it everywhere, Amazon or wherever your source is. So most people you just refer it to NAC, and NAC nutrient you're going to find all the links.

Okay. Amy says, "**You mentioned liposomal. I've heard a couple of clinicians remark they have not seen a strong benefit compared to whole food version of C in particular. Is liposomal worth a significant extra cost?**"

For me, I absolutely think liposomal is worth the effort. I can only tell you as a clinician. They haven't done studies where they compare one form of glutathione delivery to the other. So there's a part of it where you can hear different preferences from different practitioners and different people taking it with different experiences and from my bias and from my experience liposomal glutathione works fantastic.

Okay. "**How does one accurately determine they have enough glutathione or not?**"

How does one determine if you have enough glutathione? Just assume. So it depends on what your goals are. Again, you can do a lab test to kind of give you ratios, but the lab test is dynamic and changes even hour to hour so it's not as stable as you would think. So that's one way.

The other key thing is if you just have an inflammatory condition, you can raise glutathione.

I can tell you myself, my daughter, my wife, we all have been taking glutathione forever. My daughter is 14, she's been taking it since she was probably two every morning, every day. She doesn't have — we don't measure her levels being low. We don't measure... We don't assume she has symptoms of... She doesn't have an inflammatory condition. It's just done preventatively to raise antioxidants.

So the key thing is, is it worth the time and energy for a person to try to raise their glutathione levels? And I think that's going to be a personal call, but you definitely would be more on the scale of considering it if you have an inflammatory condition or if you have inflammation.

If you have something associated with that, or you're just really into health prevention and there's different people with different value systems for their health and how they want to spend their resources. And that's the key factor there.

Okay. Sorry. So **someone asks if there are any methylation issues that would cause you to not take glutathione?**

Is there any methylation issues to not take glutathione?

No. When you look at the conversion of a methyl donors and cysteine to cystine, if people have methyl donor defects, they may be inefficient in making glutathione, but that doesn't... They would actually have a greater need to take glutathione.

So methylation defects, which impact cysteine metabolism to cystine by the transfer of one methyl group, one carbon group do happen, especially if you see serum high homocysteine and those defects even strongly suggest you should take things to raise your glutathione, because if you have a methylation issue, that's another mechanism where your glutathione levels can be depleted.

Okay. Ken, "**What's the percentage of population has SNPs and can't make glutathione?**"

What percentage of population has single nucleotide polymorphisms that can't make glutathione? I'm not sure what the actual percentage is, but I can tell you it's quite high and it doesn't mean they can't completely make glutathione, it just means they're less efficient with them. So there really isn't discovery of this main gene where like, "Oh my God, you have this gene, you cannot make it."

So lots of people have different variants and different glutathione producing enzymes to make glutathione. And the problem is that we have all these labs doing these tests for a single nucleotide polymorphisms, and they're just picking out the ones that are easy to do, and are inexpensive. There's so many different SNPs with the enzymes glutathione reductase and glutathione peroxidase, and so many versions of that.

We're not even measuring those and the labs that are doing these genetic tests for SNPs, I really think are giving a false level of information because you can't make much assumptions with what they're offering. So a lot of people have SNPs for all different pathways, including glutathione, but for the ones that have been discovered, none of them are significant that you're at significant risk for making it.

At the end of the day the strategy would be the same — sleep, exercise. Do the things we talked about in the immune resilience protocol [free Everyday Immune Resilience program]. If you just joined us, that's at drknews.com. And then look at the precursors and nutrients we've been discussing.

Okay. John asked, "**Do other things besides food and sleep raise glutathione levels like exercise, yoga, deep breathing?**"

So the things that raise glutathione levels will be things that actually put a demand on your antioxidant system. And exercise is really the key one, and the more intense you exercise is actually, and the more aggressive free radical production use, the more aggressive your antioxidant reserves come in to quench that. So it really is just... Those are the main lifestyle factors.

Sleep helps you not just have your enzymes work more efficiently, so you can make glutathione. Exercise boost up your antioxidant enzymes to activate, to produce it. And then the diet you eat, that is hopefully high in foods that are high in sulfur can really be a key factor as well.

Okay. Christine, "**Can glutathione help with Hashimoto's?**"

Can glutathione help with Hashimoto's? Well, absolutely. I'll say again, there's not a large study published on glutathione. There are some studies on glutathione and Hashimoto's thyroiditis, and there's some evidence that glutathione is a key mechanism and where it prevents the oxidative stress pathways that are associated with the destruction of the thyroid gland.

There's some studies with cruciferous vegetables being given to patients who have thyroid cancer. They also have oxidative stress in the thyroid gland similar to Hashimoto's and it's shown to benefit the inflammatory response, but there hasn't been a large clinical trial that's given one group glutathione, one group a placebo, and then they monitor Hashimoto's and see if it helps.

So theoretically it should be important for all autoimmune disease patients, because in summary, it's at least an antioxidant. It helps modulate T-reg cells. It helps the barriers from breaking down, which are all critical mechanisms for autoimmunity. So there's a lot of inference of the evidence that glutathione could be really beneficial to Hashimoto's patients and very little risk.

Okay. **Dr. Perlmutter spoke about glutathione IV helping Parkinson's. Do you have any info on that?**

So the question Dr. Perlmutter talks about using for IV glutathione for...

Parkinson's. First of all, Dr. Perlmutter is awesome. He's done some breakthrough education and is really showing the world how important glutathione is for Parkinson's disease. Because one of the things that glutathione does is glutathione stops the inflammatory reaction that's involved with developing what's called α -Synucleinopathy, where you're going to build up with α -Synuclein, which then promotes Parkinson's disease.

And in some conferences, if you've had the privilege of seeing Dr. Perlmutter, he showed some case studies where they give IV glutathione, and some of these patients have an immediate change in their rigidity and stiffness and festination gait and so forth. It doesn't last forever. It's just for a short period of time, but it was interesting because it shows how an immediate anti-inflammatory compound can change neurodegenerative symptoms.

It's not a cure. It's just an expression that some people exhibit and I can tell you one of the reasons I personally take glutathione all the time is for it's neurodegenerative protection. So glutathione is essential to calm down brain inflammation, neuroinflammation, protect the blood brain barrier as well. So Dr. Perlmutter was really one of the key physicians and educators that was using it and explaining to people about using it over 20 years ago.

Okay. Let me see. Sorry. **Liposomal vitamin C or oral glutathione?**

Liposomal vitamin C or oral doesn't really make much difference. Vitamin C is easy to absorb. It's not so... The things you want to use liposomal for are things that have a hard time getting through the gut barrier.

So liposomal surrounds the compound with basically phospholipids that allow it to easily penetrate the gut. Vitamin C in a liposomal form, I don't know if it would make any sense. Vitamin C is very easy to absorb, very inexpensive, and has a tremendous impact right away. So I don't think you need to worry about a liposomal form of vitamin C.

Okay. **Can you please tell the difference between PQQ CoQ-10 and glutathione?**

They're all different. PQQ CoQ-10 and glutathione are all working at different mechanisms. They all have an antioxidant effect, but they're not even related as far as I understand.

Okay. Sean, **"Do polymorphisms or lack of presence in the glutathione genes change the way one needs a supplement or the amount of supplement."**

So the question is do gene uniqueness polymorphisms impact the way you should try to raise your glutathione levels?

Yeah. Immune supplement.

Immune supplement. So the answer is yes and no. Again, these single nucleotide polymorphisms where they look at GPX1 and variations of that showing that their body could be a little bit less efficient in making glutathione, but it doesn't mean that it completely stops it.

So you could have a gene that's inefficient, but you eat lots of sulfur containing foods, you sleep well, you're exercising, your glutathione level is going to be much, much higher than someone that doesn't have any gene uniquenesses, but they eat inflammatory diet, never eat any precursor foods to raise glutathione, don't exercise and have an inflammatory condition. Their levels are going to be much lower.

So it's just one variable, but it's not a variable enough by itself to make a significant concern. If you have a gene uniqueness you have some minor risks for raising glutathione levels, but it's not a major clinical significance. What happens is a lot of people go to functional medicine practice and they don't really understand these and they just do the gene test. And then that justifies putting lots of patients on lots of supplements. And I think it's not substantiated.

Okay. Elsie, **"Do we need both glutathione and NAC?"**

Do we need both glutathione and NAC? It's just being more aggressive if you do. Technically you just need NAC to raise glutathione, but if you take an absorbable form of glutathione, like a liposomal form then you immediately raise those levels in your system. So again, if you want to be very, very aggressive, you can take all the different things we talked about.

The nutrients, the botanicals, actually glutathione and NAC. If you're just trying to, "Hey, I want to prevent myself and get my glutathione levels up, and what's the most inexpensive and quickest way to do it?", the easiest way to do it with the most evidence, then it would just be taking N-acetyl cysteine.

Okay. A couple of people have asked, "**Can you take it if you have a CBS SNP mutation and have trouble with sulfur?**"

Okay. So there are some people that have genetic uniquenesses where they can't handle sulfur. And in those scenarios you may have a very hard time taking glutathione. So there's a small subset of people in the population that cannot handle any form of sulfur or supplementation. So whether it's glutathione or cystine, N-acetyl cysteine, Alpha-lipoic acid. They just have a hard time with it.

And for those individuals the other strategy is just to raise your vitamin C and selenium levels, and then take botanicals that help the body activate those enzymes. So you can take things like cordyceps and gotu kola and milk thistle as a strategy, if you can't handle taking sulfur supplements. So sulfur-based nutraceuticals.

Okay. Genevieve says, "**I'd like to know how to pair down supplements. I feel like you've helped me so much with these talks, but it's adding to my list of pills per day.**"

So Genevieve is saying that, "How do I cut down my supplements because it..." Listen, I get it. When you hear about supplements, "Oh, I want to try that. I want to try that." And a lot of people end up — they're into their health and people that have chronic diseases, they have an apothecary in their own home or supplements they can open up their whole food section. I don't know how to answer that for you.

Some of us have fun experimenting with different stuff and see how we feel doing different things. But I understand what you're saying. As a practitioner, I see patients coming in and sometimes they come in with a huge bag like a Santa bag, and I'm going, "What's in there." And it basically, it's 50 different supplements that they take or don't know what to do with. So that happens all the time.

So I would say depends where you're at. If you are just pretty much healthy and you just want to improve your antioxidant reserves, then N-acetyl cysteine will be good. If you have chronic inflammation, it could be one of the things that helps you with your inflammation. So it could be more of a key central nutrient for you.

What I do a lot of times with my patients that are on so many pills, I have some patients that are like, "Oh my God, I can't. I don't know what to do. I don't know how to stop them [the pills]." I ask them, "If you're going to go on a trip and you can only take four supplements in your bag, which four would they be?" And I've seen patients have serious anxiety attacks when I've asked them that. Because they just don't know they know what to do, but that might be a good way to think about it.

At the end of the day, what you're going through, a lot of people are going through. I don't have a good answer for you. You're just going to have to do some trial error and experiment what you think works best for you.

Okay. Janice, "**What is the role/importance of glutathione in phase one and or phase two detoxification?**"

So what's the role of glutathione in phase one and phase two detoxification.

Detoxification. Yeah.

Yeah. Okay. So we use the word detoxification in natural medicine all the time. And detoxification is actually called hepatic biotransformation in the literature. And what hepatic biotransformation means is that a chemical compound that's toxic gets converted by the liver to something that's not toxic. So that's called hepatic biotransformation.

And there's two phases for that. One's called phase one and one's called phase two. And the phase 1 pathway, what happens is that toxic compound comes in and actually what happens is it gets oxidized and reduced. It actually gets converted to a free radical, they change of structure of it. And then that point, it immediately goes into phase 2 and phase 2...

Phase 1 is like a funnel where you have information features like a coin sorter and you have different pathways. One's called for example, methylation, where they add a carbon group to it. One's called acetylation, they add two carbon groups to it. One's called sulfation, they had a sulfur amino acid group to it. And one's called glutathione conjugation where they add glutathione to it. There's actually more than those, but those are the main ones.

So what glutathione does is it actually helps with the part where the phase one end product gets produced to a free radical. And it has to do that to change the shape of it so it can then bind to one of these phase two end products and then something like glutathione binds to it. And then that compound is now water soluble. So we can eliminate it through our sweat and through our urine and through our fecal pathways. And that is the concept of detoxification or biotransformation.

So glutathione is critical because if you get a toxic substance or certain compound or medication that you take, you have to be able to clear that stuff out. And that's where some of these phase two pathways like methylation, simulation, sulfation, glutathione conjugation come in and you have to have healthy amounts of glutathione to do that.

So that's also another concern. If you get exposed... If you have a huge toxic load, you may want to raise your glutathione levels to make sure your system transfers them. There's some medications that are metabolized specifically through glutathione conjugation. So people can get overdose on medication or have adverse reactions to medication because of that defect.

Most drugs have their form of kinetics listed and it tells you which phase two pathways get metabolized. If you look at things like the physician's desk reference with medications and things that are published on it, they usually tell you. So it's important for that way.

The other key thing is if a compound goes through phase one pathway and it gets oxidized into a free radical so it can then bind to a phase two to be metabolized and cleared, if you have, let's say a defect in methylation, where you don't have enough methyl donors because maybe you don't have enough B vitamins in your system to help with transferring one carbon — it's called methylation — then that free radical's in your system now, and that can cause the inflammation and destruction. So glutathione can also help quench and neutralize those compounds if they're produced.

So unrelated to the immune effects and antioxidant effects, one of the key essential pathways of glutathione is how it helps us clear out toxic chemicals. And then again, I mentioned that. [crosstalk 00:48:17] I spent too much time on that. Sorry.

Okay. **If people get low blood sugar crashes easily, can NAC worsen low blood sugar.**

So NAC doesn't really have a significant impact in lowering blood sugar, but Alpha-lipoic acid will. So let me explain Alpha-lipoic acid is another compound that's been shown to raise glutathione, but also Alpha-lipoic acid also sensitizes the insulin receptor.

So actually Alpha-lipoic acid very effective in lowering blood sugar levels with people that have prediabetes or diabetes as a nutraceutical, lots of good studies published on that. But Alpha-lipoic acid also helps provide precursors to help build glutathione.

So I think you're not really worried with the N-acetyl cysteine or the other compounds that raise glutathione, but if you're using Alpha-lipoic acid as a strategy to raise glutathione realize that it does have a blood sugar lowering effect by enhancing insulin receptor site signaling.

Okay. **Do some people have so many toxins that glutathione would overload their system in detoxing at one time?**

So the question is do some people have so many toxins where glutathione is going to overload their system.

No, I don't think that's even possible. I think that's just what people assume when people adversely react to taking glutathione because of the sulfur part of it. I would say if someone is having reaction with glutathione it's more of their issue with intolerance to sulfur than it is overload with toxins.

Okay. Elaine asks, "**Companies that sell glutathione suppositories say that you use those overnight because that's when glutathione is highest for repair and regeneration. You think there's truth to that?**"

I don't know if there's any truth to having to use glutathione at night because that is when you're at most need for it. I think it's just speculation. You're actually at high — most need for glutathione when you have an oxidative stress response, not when you're sleeping. So your body's obviously recovering when you're asleep, but I don't think that statement's accurate.

Okay. Marlise, "**Please address the role of glutathione in viral diseases, for instance, EBV and the central nervous system.**"

Yeah. EBV.

So there's been some studies with influenza where they showed glutathione can decrease some of the symptoms when given. So there's a couple of those types of papers out there, but nothing dramatic. But for the most part, when someone has a virus — and this is where COVID-19 is getting very — the focus on COVID-19 or coronavirus is that it destroys the lung epithelium and creates a huge cytokine storm and lots of oxidative stress.

So there's been some attention given to glutathione as one of the key things to consider when people are trying nutraceuticals because of those mechanisms specifically. Protecting the lung barrier from breaking down, helping modulate the cytokine storm, dealing with giving more antioxidants for the oxidative stress of the infection. But as far as glutathione it's not known to have any direct antiviral activity and it doesn't necessarily activate the immune system.

It helps support T-reg cells which modulating immune system. So the key thing with it is that it's probably going to have some impact on reducing the amount of tissue inflammation and destruction in the body when someone has a virus, but you're still going to have interferon go up and people are still going to have a fever to track through immune system and glutathione is not going to have any impact on that.

Let's just kind of think of it as putting out the fire from the inflammation caused by an infection, but it doesn't necessarily directly act against the virus itself. But one of the key things where people end up maybe potentially going from when you look at things like coronavirus or infection, into a severe state is that they may not have enough antioxidant reserves to protect their tissues. And that's why things happen. Also, why autoimmunity can start to express with people that have viral infections and so forth.

Okay. Sarah says, "**NAC is much cheaper than liposomal glutathione-**

Yes.

... why not... Shouldn't everybody just take NAC then?"

Yes. That was my point. So the question is NAC is much cheaper than liposomal glutathione, shouldn't just everyone take NAC? So that was the point I was trying to make. I was saying if you're looking at the most impactful most evidence-based and cheapest way to look at factors of effect benefits and expense N-acetyl cysteine would make the most sense.

I can tell you clinically though, liposomal glutathione works great. It just does seem to work better in my personal experience, working with patients. Especially when there's an acute inflammatory response, but you can absolutely raise glutathione.

So just to summarize, the cheapest and the best way based on the evidence published that we know about to raise glutathione by one single inexpensive substance would be NAC found in

almost every single health food store, and found on Amazon. But I think clinically if you can get access to liposomal glutathione it's much more effective.

Okay. Next. Susan says, "**I was told that NAC is not well absorbed through the gut, digestive system. Is that true.**"

NAC is absorbed from the gut. All sulfoamino acids are absorbed through the gut. It's just glutathione is hard to absorb because it's an assisting N-acetyl cysteine plus glutamic acid and glutamine is a huge tripeptide so has a hard time getting absorbed. But you can absolutely absorb all sulfur amino acids and N-acetyl cysteine. No problem.

Okay. Pablo asks, "**What are the symptoms of sulfur intolerance?**"

Symptoms of sulfur intolerance is when they take glutathione, Alpha-Lipoic acid, they feel much worse, they get headaches, they feel like they have no energy, they get swollen, the body hurts. That's the biggest clue. You don't usually see as much with diet and you just see it when they start trying to take supplements that contain sulfur.

Okay. **So glutathione is both an antioxidant and an anti-inflammatory?**

Yes. So glutathione... Everything that's an antioxidant is an anti-inflammatory just in general and glutathione serves both properties. So glutathione protects the tissues in the body, but because it has antioxidant properties, it also calms inflammation, but it also directly impacts on T-reg cells, which modulate inflammation.

So glutathione is both an antioxidant, both an anti-inflammatory compound. And it's also used to support biotransformation to help clear toxins out of the body or pollutants out of the body. So it has lots of key regulatory functions.

So if you do react to sulfur, what is the best way to raise glutathione?

So once again, this question came up earlier, if you do react to sulfur, what's the best way to raise glutathione? Then you can use things like vitamin C, selenium and then you can use botanicals that raise glutathione, which would be things like milk thistle, cordyceps, and gotu kola.

What does the L stand for on my IM injection bottle L-glutathione.

L-glutathione is just in reference to the shape of the glutathione. The structure of it. So it's just an L form. So it's related to the biochemical shape. They use the term L.

Okay. **Why are some people having negative effects when taking glutathione?**

Why are some people having negative effects taking glutathione? I don't know. It could be the sulfur related issue. It's pretty rare to hear that, so I'm not sure why that would happen.

Okay. **Liposomal glutathione seems to always come in soy or sunflower-based phosphatidylcholine. If one is soy or sunflower intolerant can it still safe to consume or will it contribute to auto-immune activity?**

Yeah. So if you look at the different types of liposomal versions, whether they come from a soy-based or not, and they have phospholipids, that's not the same thing as soy protein. So most people that even have soy intolerances can tolerate those types of compounds. And when you look at soy protein and soy protein isolates, there's like 28 different branches of the soy protein, and some people react to parts of it versus other parts of it.

In reaction, looking at the phosphatidyl portion of the soy, that's not the same thing as a protein that many people react to. So you can absolutely expect not to have any reactions, even though you may have reactions with soy protein with liposomal of glutathione.

I think we have time for just how many more?

A couple more. I have some here. I just want to make sure I covered [crosstalk 00:57:21]

So one of the questions. **Do we need to take more glutathione supplement as we age?** I would say yes, because studies show every decade, our levels start to come down.

How do you know if glutathione is working? That's another question that was asked that comes up. Again, you don't. It's one of those things, even when take it in antioxidant, you don't necessarily know if it's working or not.

The research shows that it has an anti-inflammatory effect and a protective effect on the body. And we know studies clearly show when people progress into an inflammatory destructive state from any kind of inflammatory condition, there's a direct measurement of glutathione level being depleted. And when the gut barrier and lung barrier and blood-brain barrier break down, it's strictly related to glutathione levels being depleted.

So you're not going to necessarily... For most people when they take things to raise glutathione then they can notice a significant benefit. And the other hand, if you do notice a significant benefit, inflammation goes down, you feel better, you have more energy, that really means you probably have some inflammation and then you want to increase your dose.

Okay. **Can taking liposomal glutathione help idiopathic neuropathy?**

Maybe, maybe not. So we do idiopathic neuropathy means that they really don't know the reason why the nerve damage is happening. A really common cause of idiopathic neuropathy that people overlook is an autoimmune mechanism. So that's one thing. And with idiopathic neuropathy, I've worked with lots of cases of idiopathic neuropathy, they're all different.

Some patients, when they do an anti-inflammatory diet approach, [...] taking anti-inflammatory nutraceuticals, it helps calm down some of their pain and inflammation. And for other people, nothing makes a difference, even taking corticosteroids or significant anti-inflammatory compounds. Pharmaceutical compounds have very little effect. And also there's a difference between small fiber or large fiber neuropathies, small fiber neuropathies, really don't respond to much of anything to calm down the inflammation pain.

Large fiber neuropathies seem to do much better with an anti-inflammatory approach. So that's another factor in it, but overall it still may provide some protection, protecting neurons from

further degeneration. Because although most people that have neuropathy think about the pain, the function of that nerve being damaged is also critical.

But physiologically speaking, having antioxidants can be very protective against the neuron, whatever the mechanism of the idiopathic neuropathy may be. So I would encourage taking it, if I had it, I would take it, but It may not help with pain, especially if you have C fiber neuropathy.

Thank you everyone for joining. It's always so nice to see people interested. I mean, people actually love glutathione, who would've thought? I love glutathione.

Oh, **the other thing was sublingual glutathione**. Sublingual glutathione is another question that people had. Sublingual glutathione is... I'm not sure about it. Have you used sublingual... There isn't any significant studies to tell us if sublingual glutathione is better than one or the other, and I haven't seen any dramatic impacts of patients taking sublingual glutathione.

So I am not for or against it it just hasn't seemed to be that great of a difference if it's sublingual or not. I think you still have issues with absorption through the mucosa, even if you take a liposomal form. I mean, if you take a sublingual form. So I think liposomal sublingual might work well, but just the actual glutathione being a sublingual form by itself I don't think it would make any impact in an absorption versus the other.

Okay. I think we pretty much got most of the questions. Some of them were just kind of repeats, there the other ones that you might be able to watch the video. Thank you all for joining us and we'll have a different topic soon. And once again, thank you. Thank you everyone. And thank you for all the positive comments and I hope everyone has a great day. Thank you.

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