## Metformin and Kidney Safety

Let me start Let me start with a question. I hear it with a question. I hear it in my in my office almost office almost every week. Someone sits down every week. Someone sits down across from me and across from me and takes a takes a small white small white bottle of pills out of her purse.

Look at me. And Look at me. And puts it on the table. puts it on the table. As if it's physical evidence As if it's physical evidence in court or something in court or something like that. And he says, " Doctor, my cousin Doctor, my cousin told me that this told me that this thing is eating away at my thing is eating away at my kidneys." Is this true? And I kidneys." Is this true? And I love this question.

Because an honest Because an honest answer is more interesting answer is more interesting than any than any side in an online argument. Those who argument. Those who pray for pray for metformin will not metformin will not tell you the whole tell you the whole truth. And those who truth. And those who shout that it's poison shout that it's poison won't tell either. So won't tell either. So today, as today, as an endocrinologist, as your an endocrinologist, as your trusted doctor, we're going trusted doctor, we're going to do something to do something real. We will be real. We will be truly truly truly fair. And fair. And honest. Here's the short honest. Here's the short version. And then we'll version. And then we'll spend the rest of spend the rest of the video proving it. Let me tell you this: me tell you this: metformin does not destroy metformin does not destroy healthy kidneys. But this is the healthy kidneys. But this is the key point— healthy kidneys. But healthy kidneys. But kidneys that already have kidneys that already have problems can problems can turn turn turn metformin into a metformin into a danger, and we'll danger, and we'll talk about this in talk about this in more detail. The direction of more detail. The direction of cause and effect is of effect is of great great great importance, and almost no importance, and almost no one understands it one understands it correctly.

correctly. Let's start with why Let's start with why this rumor even this rumor even exists. Because it didn't exists. Because it didn't arise in a arise in a vacuum.

vacuum. vacuum. Metformin has an older, Metformin has an older, worse cousin. In the 50s and worse cousin. In the 50s and 60s, there was a 60s, there was a drug called drug called phenformin. From the same phenformin. From the same family. And because of it, family. And because of it, many people many people developed a developed a developed a dangerous dangerous dangerous buildup of acid buildup of acid in the blood called in the blood called lactic acidosis.

lactic acidosis. Enough people died that it was taken off the market in the taken off the market in the 70s. Metformin 70s. Metformin survived, but inherited the survived, but inherited the family's reputation.

family's reputation. Then, for decades, the metformin packaging metformin packaging said: "Do not said: "Do not use use use if if if creatinine level is above 1.5 in creatinine level is above 1.5 in men or 1.4 in men or 1.4 in women." And when women." And when a patient sees a a patient sees a kidney score in a medication warning, their brain medication warning, their brain automatically draws automatically draws one conclusion. He one conclusion. He suggests that it was the suggests that it was the medication that damaged the kidneys.

medication that damaged the kidneys. This assumption is false. And I want you to And I want you to realize this well, because this is the realize this well, because this is the most important thought in most important thought in this video.

Metformin is not Metformin is not broken down by broken down by broken down by the liver. It is not the liver. It is not metabolized into anything metabolized into anything else. Approximately 90% of what is absorbed is excreted is excreted unchanged in the urine.

unchanged in the urine. Your kidneys are the Your kidneys are the exit door. So, exit door. So, your kidneys are clearing your your kidneys are clearing your body of body of metformin.

metformin. metformin. Metformin does not cleanse Metformin does not cleanse your kidneys. Think of your kidneys.

## How Metformin Works and When It Becomes Risky

Think of it as a it as a toll booth on the road. toll booth on the road. If If If all employees are working at the checkpoint all employees are working at the checkpoint, cars, cars are passing by and there are passing by and there are no traffic jams. But are no traffic jams. But if you close if you close half the lanes, there half the lanes, there will be will be traffic jams on the highway. Now traffic jams on the highway. Now the problem is not that the the problem is not that the machines damaged the machines damaged the payment point.

payment point. The problem is that The problem is that the checkpoint the checkpoint has slowed down. And now there are has slowed down. And now there are too many cars too many cars parked in one place. When kidney function. When kidney function decreases, decreases, decreases, metformin metformin metformin accumulates. And at high accumulates. And at high enough enough enough levels, metformin levels, metformin directs your directs your metabolism to metabolism to produce lactate.

produce lactate. That's where the That's where the acid problem comes from. acid problem comes from. So, the true So, the true statement is this. statement is this.

Kidney disease makes Kidney disease makes metformin metformin metformin risky. risky. risky. Metformin does not make Metformin does not make the kidneys sick. So, the kidneys sick. So, what risk are we what risk are we talking about? Let's talking about? Let's operate with real operate with real numbers. Because vague numbers. Because vague fear doesn't fear doesn't help anyone. Metformin- associated associated associated lactic acidosis lactic acidosis lactic acidosis is defined as a is defined as a blood pH below 7.35 with a blood pH below 7.35 with a lactate level above lactate level above five. When this five. When this happens, it is truly happens, it is truly dangerous. The dangerous. The mortality rate in mortality rate in recorded recorded recorded cases is cases is between 30 and 50%. And it's even between 30 and 50%. And it's even worse when the worse when the pH is very low. But how pH is very low. But how often does this happen?

often does this happen? Estimates for the population Estimates for the population are about 3–10 cases per 100,000 3–10 cases per 100,000 patient-years. Some patient-years. Some databases indicate databases indicate higher numbers— around 40 per 100,000. But around 40 per 100,000. But here's the part that here's the part that really clarifies really clarifies the situation. When the situation. When researchers researchers researchers analyzed hundreds of analyzed hundreds of trials and trials and cohort studies, with over 70,000 patient- years of years of metformin use, they metformin use, they found no found no cases of lactic acidosis. Zero. And in the. Zero. And in the control group that did control group that did not take not take metformin, it was also zero.

metformin, it was also zero. So, we are talking about So, we are talking about an event so an event so rare that rare that huge huge huge datasets sometimes cannot datasets sometimes cannot find a single find a single instance. This means instance. This means that the medication does not destroy that the medication does not destroy the kidneys. This means that it is a the kidneys. This means that it is a rare event rare event that occurs under that occurs under certain circumstances. And these certain circumstances. And these circumstances are what I circumstances are what I really want you to really want you to remember. Because this is where remember. Because this is where people people people get hurt. It is get hurt. It is almost never a almost never a pill that pill that lies peacefully in a bottle. It's lies peacefully in a bottle. It's a pill plus a crisis.

Look who Look who ends up in ends up in intensive care with this. Kidney intensive care with this. Kidney failure, failure, failure, heart heart heart failure, failure, failure, liver liver liver failure, failure, failure, sepsis, severe sepsis, severe dehydration, dehydration, dehydration, alcohol binge, alcohol binge, intentional intentional intentional overdose. In other words, someone who was already on a who was already on a bad path, and bad path, and metformin was just metformin was just in the car. Which in the car. Which brings me to brings me to the rules that will really the rules that will really help you help you keep yourself safe. And I keep yourself safe. And I want you to

want you to write them down. Rule number write them down. Rule number one: know your estimated one: know your estimated GFR, not your GFR, not your creatinine. Since 2016, the GFR indicator has been used in creatinine. Since 2016, the GFR indicator has been used in the instructions the instructions the instructions.

## Practical Rules for Safe Metformin Use

Below 30 – metformin metformin metformin is excluded. Between 30 and is excluded. Between 30 and 45—you should not start taking it 45—you should not start taking it. And if you're already. And if you're already taking it, we taking it, we usually reduce usually reduce the dose to 1,000 mg per day the dose to 1,000 mg per day or less and monitor or less and monitor you closely. Above you closely. Above 45—this is considered 45—this is considered safe, but safe, but kidney function should be kidney function should be checked every 3–6 checked every 3–6 months. More than once.

months. More than once. Not when Not when you remember. Every 3–6 you remember. Every 3–6 months. Rule number months. Rule number two, and that's what saves two, and that's what saves lives. Rules during lives. Rules during illness. If you have illness. If you have vomiting, diarrhea, vomiting, diarrhea, severe intestinal severe intestinal upset, a high upset, a high fever, are fever, are unable to drink unable to drink fluids, or are fluids, or are dehydrated from dehydrated from the heat, stop the heat, stop taking metformin taking metformin until you can until you can eat and eat and drink normally again. Why? Because drink normally again. Why? Because dehydration dehydration dehydration temporarily impairs temporarily impairs kidney function.

kidney function. The drug The drug The drug accumulates, and this accumulates, and this creates the basis creates the basis for problems. The same for problems. The same applies applies applies if you are preparing for if you are preparing for surgery or a surgery or a CT CT CT scan with scan with contrast— contrast— stop taking it.

stop taking it. Rule three: Rule three: alcohol. Excessive alcohol. Excessive alcohol consumption alcohol consumption with metformin is a bad combination, is a bad combination, as alcohol as alcohol itself stimulates itself stimulates lactate production lactate production and overloads and overloads the liver. I don't mean a the liver. I don't mean a glass of wine with glass of wine with dinner. I'm talking about dinner. I'm talking about drunkenness. Now drunkenness. Now let's look at the other let's look at the other side of the coin, because this is where the side of the coin, because this is where the story gets weird.

story gets weird. If metformin were If metformin were slowly destroying slowly destroying the kidneys, diabetics the kidneys, diabetics on metformin would have on metformin would have worse worse worse kidney function than kidney function than those not taking it. So those not taking it. So what does the what does the data actually show?

data actually show? Mostly the Mostly the Mostly the opposite. In more than opposite. In more than 10,000 patients with type 2 diabetes and type 2 diabetes and stage 3 kidney disease, followed for about 7 years, about 7 years, long-term use of long-term use of metformin was metformin was associated with a 35% lower mortality rate and a 33% lower progression to end-stage kidney disease. Other large. Other large cohort studies cohort studies have shown the same have shown the same result. Lower result. Lower mortality at mortality at glomerular glomerular filtration rate (GFR) in filtration rate (GFR) in the range of 30–60, better the range of 30–60, better results compared results compared to sulfonylurea. Now I have to be an. Now I have to be an honest doctor, not a honest doctor, not a salesman. These are salesman. These are observational observational observational studies, not studies, not randomized randomized randomized trials. And trials. And there is an there is an unpleasant unpleasant unpleasant feature in observational data—“ healthy healthy user bias.” Doctors user bias.” Doctors discontinue metformin discontinue metformin in patients whose condition in patients whose condition worsens. So worsens. So people who continue to people who continue to take it for the take it for the fifth year fifth year look better, look better, partly because partly because their condition was already their condition was already better. It's like better. It's like concluding that running concluding that running shoes prevent shoes prevent heart attacks because heart attacks because people who wear them are people who wear them are healthier.

healthier. healthier. This is partly thanks to sneakers. This is partly thanks to sneakers. And partly those who And partly those who buy them. And the picture is not so buy them. And the picture is not so rosy.

rosy. rosy. One large One large study study study of patients with of patients with advanced advanced advanced kidney disease found that kidney disease found that taking metformin taking metformin was associated with higher was associated with higher mortality. So there mortality. So there are nuances. In are nuances. In mild and moderate mild and moderate kidney disorders, it kidney disorders, it has a neutral or has a neutral or even protective effect. And in even protective effect. And in severe stages, he severe stages, he ceases to be your ceases to be your friend. So, no.

friend. So, no. Metformin does not destroy Metformin does not destroy your kidneys. And I'm not going to your kidneys. And I'm not going to stand here and pretend that makes it a makes it a vitamin. And now I'll vitamin. And now I'll tell you what metformin actually does, which metformin actually does, which no one warned you about.

Problem number one. Problem number one. And this is the most important thing. And this is the most important thing. Vitamin B12 deficiency. Vitamin B12 deficiency. Metformin Metformin Metformin prevents prevents prevents the absorption of B12 in the lower the absorption of B12 in the lower small small small intestine. And depending on the intestine. And depending on the dose and duration, dose and duration, 10 to 30% of those who 10 to 30% of those who take the drug take the drug long-term long-term eventually experience a eventually experience a deficiency. In one deficiency. In one study, clinical study, clinical neuropathy neuropathy neuropathy was observed in 45% of metformin users compared metformin users compared to approximately 32% among to approximately 32% among those who did not those who did not take it. Now take it. Now think about what this think about what this means in real means in real life. The patient life. The patient complains of complains of burning and burning and tingling in the feet.

tingling in the feet. He comes to the He comes to the clinic. What is everyone clinic. What is everyone assuming? assuming? Diabetic Diabetic Diabetic neuropathy. High neuropathy. High sugar levels sugar levels damaged the nerves.

damaged the nerves. The case is closed. Here's The case is closed. Here's gabapentin. But gabapentin. But B12 deficiency causes B12 deficiency causes exactly the same exactly the same symptoms. Numbness, symptoms. Numbness, tingling, burning, balance problems. And if this balance problems. And if this continues continues continues long enough, the damage long enough, the damage becomes irreversible.

So you may have a So you may have a patient whose nerves patient whose nerves are destroyed not by are destroyed not by the diabetes but by the diabetes but by the treatment for it.

And everyone in the office And everyone in the office congratulates themselves on congratulates themselves on correctly correctly correctly diagnosing the wrong thing diagnosing the wrong thing. If you've. If you've been taking metformin for been taking metformin for more than a couple of years and no more than a couple of years and no one has checked one has checked your B12, that's a gap in your B12, that's a gap in your treatment. And your treatment. And check it check it properly.

properly. properly. Serum B12 levels are an inaccurate test. are an inaccurate test. Therefore, if the indicators are Therefore, if the indicators are borderline, we add borderline, we add methylmalonic methylmalonic methylmalonic acid and acid and homocysteine, which homocysteine, which show what is show what is happening happening happening inside the cell, inside the cell, not just in the blood. And not just in the blood. And when we when we substitute it, I choose substitute it, I choose methylcobalamin over methylcobalamin over cyanocobalamin, because cyanocobalamin, because you don't have to you don't have to give up a molecule of give up a molecule of cyanide to get the cyanide to get the vitamin. Problem vitamin. Problem number two is your number two is your intestines. Much of metformin's action metformin's action occurs in occurs in the gut, where it the gut, where it changes your microbiome.

## Metformin Side Effects and Long-Term Tradeoffs

changes your microbiome. Sometimes it's useful. And Sometimes it's useful. And sometimes it's the reason why 20-plus why 20-plus percent of people percent of people suffer from suffer from diarrhea, gas, diarrhea, gas, cramps, and that cramps, and that wonderful feeling of wonderful feeling of not trusting not trusting your own body

in the your own body in the grocery grocery grocery store. The store. The extended- extended- extended- release form release form release form helps many people.

helps many people. Taking it with food Taking it with food helps, but some helps, but some people simply can't people simply can't tolerate it. And tolerate it. And telling them to “just telling them to “just endure it” is endure it” is lazy medicine.

Problem number three, and Problem number three, and it's important for those it's important for those thinking about thinking about longevity. longevity.

Metformin is a Metformin is a weak weak weak mitochondrial mitochondrial mitochondrial inhibitor. The debate inhibitor. The debate about whether it about whether it directly blocks complex directly blocks complex one at normal one at normal doses is still ongoing.

doses is still ongoing. But here is the practical But here is the practical conclusion. In a conclusion. In a randomized randomized randomized trial of older trial of older adults who engaged in adults who engaged in progressive progressive progressive resistance resistance resistance training, the metformin group gained less gained less muscle than the muscle than the placebo group. Less muscle.

Why am I so worried Why am I so worried about this? Because about this? Because muscles are your glucose utilization system. Muscle is glucose utilization system. Muscle is your your your insulin sensitivity. Muscle is insulin sensitivity. Muscle is your metabolic your metabolic bank account.

bank account. And skeletal And skeletal muscle mass is one of the muscle mass is one of the strongest strongest strongest indicators of how indicators of how well you age and well you age and how long you remain how long you remain independent. So, independent. So, if you're 65, if you're 65, lifting weights, lifting weights, doing everything right, doing everything right, and the medication is slowly and the medication is slowly slowing down your slowing down your adaptation, that's a real adaptation, that's a real topic for conversation, not topic for conversation, not heresy. The same logic heresy. The same logic applies to the hype that applies to the hype that metformin metformin metformin prolongs life.

prolongs life. Perhaps. There's Perhaps. There's real research underway to find out, but the find out, but the same mild same mild mitochondrial mitochondrial mitochondrial stress that can stress that can trigger a beneficial trigger a beneficial response response response can also negate your can also negate your training. You can't training. You can't claim claim claim benefits while ignoring benefits while ignoring costs when they costs when they come from the same come from the same source. And problem source. And problem number four, which is number four, which is philosophical but philosophical but the most important of all: the most important of all: metformin does not address metformin does not address the cause of your the cause of your diabetes. It reduces diabetes. It reduces hepatic hepatic hepatic glucose output and slightly glucose output and slightly improves improves improves insulin sensitivity. He insulin sensitivity. He manages the indicators.

manages the indicators. It does not remove the It does not remove the visceral fat that visceral fat that surrounds your liver surrounds your liver and and and pancreas. It does not pancreas. It does not restore your sleep, restore your sleep, muscle mass, muscle mass, stress physiology, stress physiology, fructose levels, or fructose levels, or inflammation. So, if inflammation. So, if you take it and you take it and don't change anything, don't change anything, you are not treating the disease, but masking it while, but masking it while it quietly progresses it quietly progresses according to the best according to the best test results. Okay, so what test results. Okay, so what actually destroys the actually destroys the kidneys in diabetics?

kidneys in diabetics? Because something is destroying it. Because something is destroying it. One in three One in three diabetics develops diabetics develops kidney disease, and it's not kidney disease, and it's not because of metformin.

because of metformin.

## Kidney Damage in Diabetes: Real Causes

Number one: years of Number one: years of high high high blood sugar. Glucose blood sugar. Glucose damages the tiny damages the tiny filters in the kidneys filters in the kidneys through glycation, through glycation, oxidative stress, oxidative stress, and pressure changes. Each and pressure changes. Each kidney has about a kidney has about a million filtering million filtering units, and when they are units, and when they are forced to operate in forced to operate in hyperfiltration mode hyperfiltration mode for decades, they for decades, they become scarred. You do become scarred. You do n't feel it. You n't feel it. You can lose can lose half of your half of your kidney function and feel kidney function and feel completely normal, which is why completely normal, which is why people don't people don't take it take it seriously until it's too seriously until it's too late. Number late. Number two: blood two: blood pressure. Hypertension and pressure. Hypertension and diabetes together are a diabetes together are a tandem that fills tandem that fills dialysis centers. If dialysis centers. If your blood pressure is 150 over 90 and you your blood pressure is 150 over 90 and you brush it off because brush it off because you feel good, you are you feel good, you are actively trading actively trading kidney tissue for kidney tissue for comfort. Number three. And comfort. Number three. And this makes me this makes me want to stand on the want to stand on the table and scream. NSAIDs.

Ibuprofen, naproxen. Ibuprofen, naproxen. Those medications you've been taking Those medications you've been taking for knee pain for knee pain three times a day three times a day for 11 years.

for 11 years. They narrow They narrow the blood flow to the kidneys. the blood flow to the kidneys. For a diabetic with For a diabetic with borderline borderline borderline kidney function, this is kidney function, this is real damage real damage that no one that no one takes into account. Because they are takes into account. Because they are over-the-counter, they over-the-counter, they are perceived as are perceived as candy. Number four. Dehydration and. Dehydration and repeated acute repeated acute kidney injury. Every kidney injury. Every episode when the kidneys episode when the kidneys take a hit—a serious illness, a serious illness, a contrast contrast contrast study, or a difficult study, or a difficult hospitalization— hospitalization— leaves them a little leaves them a little weaker. The kidneys do not weaker. The kidneys do not have a perfect have a perfect memory for memory for recovery. Number recovery. Number five: contrast five: contrast medium, certain medium, certain antibiotics, antibiotics, antibiotics, sleep apnea, and chronic sleep apnea, and chronic low-grade inflammation low-grade inflammation due to visceral due to visceral fat. Untreated fat. Untreated sleep apnea raises sleep apnea raises blood pressure blood pressure all night, every night, and all night, every night, and most people most people don't even don't even realize it.

Here is a list of Here is a list of lab lab lab tests that I advise tests that I advise you to request. And if you to request. And if your doctor doesn't want to your doctor doesn't want to prescribe them, find prescribe them, find one who will.

Not only creatinine, Not only creatinine, GFR, urine GFR, urine albumin to albumin to creatinine ratio, creatinine ratio, which detects which detects damage years damage years before creatinine before creatinine changes, cystatin C, changes, cystatin C, which is more accurate than which is more accurate than creatinine for people with creatinine for people with a lot or very a lot or very little muscle mass, little muscle mass, but also B12, ferritin, but also B12, ferritin, vitamin D, magnesium, vitamin D, magnesium, uric acid, and uric acid, and real real real blood pressure readings blood pressure readings at home, not in a chair at home, not in a chair after you've after you've been rushing through traffic been rushing through traffic. And while we're here,. And while we're here, let me let me debunk another debunk another myth. People tell me, myth. People tell me, "My uncle took "My uncle took Metformin and ended up Metformin and ended up on dialysis, on dialysis, so that proves so that proves it's harmful." No.

it's harmful." No. This proves that This proves that your uncle had your uncle had diabetes for 25 diabetes for 25 years. Metformin was years. Metformin was in the room when in the room when the house burned down. But the house burned down. But he didn't hold a match. If you want to know. If you want to know what was holding him back, what was holding him back, look at his look at his glycated glycated glycated hemoglobin (A1C) level in hemoglobin (A1C) level in 2009. I'll mention 2009. I'll mention this too because it's really this too because it's really good news. If good news. If you already have you already have kidney damage, there are two kidney damage,

there are two classes of drugs with classes of drugs with convincing convincing convincing randomized randomized randomized evidence of evidence of evidence of slowing slowing kidney deterioration. SGLT2 inhibitors kidney deterioration. SGLT2 inhibitors and GLP-1 drugs. This is and GLP-1 drugs. This is not hype. This is not not hype. This is not observational data. These are observational data. These are real-world trials real-world trials with kidney function with kidney function as the endpoint.

as the endpoint.

## Berberine as an Alternative and Supplement Considerations

So, if you have So, if you have protein in your urine and no protein in your urine and no one one one has told you about it, this is a has told you about it, this is a conversation worth having conversation worth having. And this is a. And this is a separate separate separate issue from the discussion issue from the discussion about Metformin. Now about Metformin. Now let's talk let's talk about a question that about a question that I know is already waiting in the I know is already waiting in the comments. What about comments. What about berberine? Berberine is a plant is a plant alkaloid alkaloid alkaloid found in found in barberry, barberry, barberry, barberry, and mahonia barberry, and mahonia hollyhock. And it's hollyhock. And it's really interesting because it really interesting because it works by some of the works by some of the same mechanisms as same mechanisms as Metformin. It Metformin. It activates AMP- activated activated activated protein kinase (AMPK).

protein kinase (AMPK). It is a cellular It is a cellular energy sensor that causes energy sensor that causes your cells your cells to burn rather than to burn rather than store. It store. It reduces reduces reduces glucose production by the liver, glucose production by the liver, improves improves improves insulin sensitivity, and insulin sensitivity, and positively alters the positively alters the gut microbiome.

gut microbiome. And the data on the effects in And the data on the effects in humans is better than for humans is better than for most supplements. In a most supplements. In a randomized randomized randomized trial among trial among type 2 diabetics, type 2 diabetics, berberine reduced berberine reduced A1C levels from approximately A1C levels from approximately 9.5 to 7.5. And this effect 9.5 to 7.5. And this effect was comparable to was comparable to Metformin in the same Metformin in the same study.

study. Meta-analyses of Meta-analyses of dozens of trials dozens of trials continue continue continue to show significant to show significant reductions in reductions in fasting, postprandial glucose, fasting, postprandial glucose, and A1C levels. It and A1C levels. It also improves also improves triglyceride triglyceride triglyceride and LDL levels, which and LDL levels, which Metformin has little Metformin has little effect on. So, you effect on. So, you get a get a get a metabolic metabolic metabolic comprehensive approach.

comprehensive approach. But there is a nuance. And I'm But there is a nuance. And I'm going to tell going to tell you about it, even though I you about it, even though I sell this sell this product myself, because you product myself, because you should never should never trust those who don't trust those who don't.

. Regular berberine Regular berberine has terrible has terrible bioavailability. bioavailability. bioavailability. Less than 1% enters Less than 1% enters your bloodstream. Your your bloodstream. Your intestines are actively intestines are actively pushing it back out.

pushing it back out. And the liver processes And the liver processes what's left. That's what's left. That's why each of those why each of those positive positive positive studies studies studies used 1,500 used 1,500 mg per day, mg per day, divided into three divided into three doses. And that is why doses. And that is why many people many people experience gastrointestinal disorders. Most of the. Most of the dose simply dose simply remains in remains in the intestines, the intestines, causing causing causing irritation. Here's the irritation. Here's the real reason real reason why dihydroberberine why dihydroberberine matters. This is a matters. This is a reduced form of reduced form of berberine that is berberine that is absorbed much more absorbed much more efficiently and efficiently and converted back converted back into berberine in your into berberine in your body. In a body. In a human absorption study, 100 human absorption study, 100 mg of dihydroberberine mg of dihydroberberine provided provided plasma concentrations plasma concentrations approximately six to seven approximately six to seven times higher than 500

mg of times higher than 500 mg of regular berberine. Six to seven times. Six to seven times at a dose that is 5 times at a dose that is 5 times lower. Peak levels lower. Peak levels were almost 10 times were almost 10 times higher. That's why we higher. That's why we created Super Berberine at created Super Berberine at sugarmds.com with sugarmds.com with dihydroberberine, dihydroberberine, dihydroberberine, instead of instead of just pouring just pouring more powder into a more powder into a large capsule. Less large capsule. Less in the intestines, more in the in the intestines, more in the blood. Fewer people blood. Fewer people quit taking it because of quit taking it because of cramps. And if you cramps. And if you prefer prefer prefer the classics, our the classics, our standard berberine is what you should is what you should take three times a take three times a day, as in the day, as in the studies. In any case, combine any case, combine it with magnesium, it with magnesium, as most as most people with people with insulin resistance insulin resistance insulin resistance have a hidden have a hidden deficiency that disrupts glucose control. And also with glucose control. And also with chromium and alpha- lipoic acid, lipoic acid, which help with both which help with both glucose processing and nerve symptoms. Two fair nerve symptoms. Two fair warnings. If you warnings. If you take insulin take insulin or a or a or a sulfonylurea, sulfonylurea, sulfonylurea, such as glipizide, such as glipizide, berberine may berberine may increase their effects and lower your blood sugar too much. Therefore, lower your blood sugar too much. Therefore, check your check your sugar levels and talk to your sugar levels and talk to your doctor about doctor about adjusting your dose.

adjusting your dose. Additionally, berberine Additionally, berberine interacts with interacts with liver enzymes liver enzymes that process that process many medications. Therefore, many medications. Therefore, if you are taking if you are taking several medications, do not several medications, do not engage in engage in engage in amateur activities.

amateur activities. Avoid Avoid Avoid it completely during it completely during pregnancy and pregnancy and never give it to children. So, is berberine a So, is berberine a replacement for metformin?

For some people with For some people with mild mild mild illness who want to illness who want to get off get off medication, this is a legitimate medication, this is a legitimate topic to discuss topic to discuss with their doctor. For with their doctor. For someone with an someone with an A1C level of 11 and A1C level of 11 and ketones in their urine?

ketones in their urine? Definitely not. And anyone on the internet who anyone on the internet who tells you otherwise is tells you otherwise is playing with your playing with your eyesight and your feet. So, let me. So, let me summarize.

summarize. summarize. Metformin does not destroy Metformin does not destroy your kidneys. It's not the your kidneys. It's not the villain, but villain, but metformin isn't metformin isn't harmless either, and it's harmless either, and it's definitely not a definitely not a treatment strategy. This is a treatment strategy. This is a tool. It gives tool. It gives you time and slightly better you time and slightly better performance, but the price performance, but the price is B12 deficiency, occasional gut issues, and perhaps a slight decrease in your slight decrease in your ability to build ability to build muscle. What muscle. What actually protects actually protects your kidneys doesn't your kidneys doesn't look glamorous, look glamorous, but it works.

Reduce your Reduce your sugar levels. Get your sugar levels. Get your blood pressure down to blood pressure down to normal, preferably 120 over 70, normal, preferably 120 over 70, or, if you want to be or, if you want to be less strict, 130 over 80.

less strict, 130 over 80. Build muscle. Build muscle. Get rid of Get rid of Get rid of visceral fat. visceral fat. Stop Stop Stop taking daily ibuprofen.

taking daily ibuprofen. Treat sleep apnea. Drink water.. Drink water. Check your Check your urine albumin level urine albumin level every year. And preferably every every year. And preferably every 6 months. I do this 6 months. I do this quarterly.

quarterly. quarterly. Correct B12 deficiency and Correct B12 deficiency and use use use targeted supplements to targeted supplements to support support support biological processes, biological processes, not just not just mask

the numbers.

mask the numbers. The pill is not the enemy. The The pill is not the enemy. The enemy is passivity. Has this video changed Has this video changed your attitude towards your attitude towards that little white that little white pill? Please like it pill? Please like it.

.. Share this with someone who is Share this with someone who is afraid of it, afraid of it, or someone who or someone who feels too feels too calm. We calm. We both need this. Subscribe, both need this. Subscribe, see you in the see you in the next video, and next video, and also check out the also check out the sources for sources for today's today's today's conversation.