



Glucose Testing: Understanding Glucose and Insulin Patterns

Transcript

Hello, this Dr. Ritamarie Loscalzo and welcome to *Understanding Glucose And Insulin Patterns*. We are here to learn about how to test your own glucose levels and what that means about your insulin levels and how to interpret the graphs that you get when you do your own testing.

Before I begin I just want to make sure that you understand that this presentation isn't intended to replace a one-on-one relationship with a qualified doctor or healthcare practitioner. It's also not intended as medical advice. It's intended as a sharing of my knowledge and information from my research and experience.

I encourage you to consult with your doctor, your practitioner if you are under the care of one, if you have any diagnosed condition or you are on any medication, before you start to test and before you start to follow some dietary and lifestyle changes that may be indicated.

Let's start with **What Does Normal Blood Sugar Mean?** and 'when I do this sugar testing, what does it mean when I get these results?' I got this graph, it was taken by a study that was done with normal groups of people that had not been diagnosed with diabetes of any type or form.

Of course they could be borderline insulin resistant or beginning to develop insulin resistance but they do not show signs of that. They are not overtly diagnosed, and that's what they mean by a normal population. When they tested this group they basically did a fasting baseline: from 6:00 AM until 7:30 AM they had not eaten anything.

They tested their glucose throughout that period and you can see the normal variations ranged in the 60s. It dipped down but mostly in the 60s, and at the high end it was just below 100 in the mid to upper 90s.

Once they ate which was marked at the chart at 7:30 AM, they were given a high carbohydrate meal, generally that means that there was some refined sugar and flour in that meal. It wasn't a high fiber meal. It was a high sugar meal and then they monitored them over time. What you'll see is 7:30 AM is when they ate, they all had this very similar rise, peak and fall back down to baseline, every single one regardless of where they started.

They all seemed to peak very closely at the same time, which is about 45 minutes after they ate.



The glucose gradually rose and then it started to fall back again. And at three hours later, at 10:30 AM, it was back to normal baseline. And between three and then four hours later and it went all the way up to five hours after the meal and you can see that it flattens out.

This is considered a normal curve; it never goes below the starting point by any significant amount anyway. It may vary by a couple of points here and there but typically it doesn't go much below the starting point and it doesn't go much above the peak. So where does the peak happen? Well at the low end of norm, the low end of the curve, the peak happened at about 96 or 97, so upper 90s is the highest point the glucose ever got.

At the high end, the highest point it got was about 160. On average people peaked at somewhere a little bit above 120. On the bottom curve what you are seeing is the brown line, this is the insulin, and so you watch at baseline when folks are just hanging out, these are very low insulin levels.

And then as they have more exposure to the sugars, the insulin levels peak and then they came back down to the baseline level. It takes them a little while to come on down. Meanwhile this whole time when your insulin is high you are exposing your tissues to the insulin levels and they run the risk of becoming resistant, or in the case of the blood vessels they become damaged.

I've given you a reference if you want to read more and look at the study specifically you can. I picked this out of a diabetes journal and basically it's agreed that a **normal fasting blood sugar**, and that's before a meal so really it's the first thing in the morning, but it should return to normal after three hours, **is about 83 or less**.

Many healthy people have blood sugars that are in the high 70s and that's the range we are looking for. People who have their blood sugars up at 95 to 100 and they are told that they are normal; this is not normal. There are studies that suggest this range predicts diabetes that might have been diagnosed a decade later.

If you are running with your sugars that are around 100 or in the mid 90s that can mean you are about 10 years away from diabetes according to the statistics. **What's a normal after-meal blood sugar?** After meal is often called the postprandial and independent of what they eat, the normal blood sugar of a truly normal person is **under 120 one or two hours after a meal. Most normal people are under 100 two hours after eating**. That's why we've been striving for 110 in the program.

When we look back at that other graph, the average was a little over 120 but it was given a high carbohydrate test meal; something that someone who is striving to be healthy is not going to eat on a regular basis. But where people who are heading towards diabetes or who don't really pay attention to what they eat, that's kind of similar to what they do eat.



There's a test that's called the **Glucose Tolerance Test** and what the glucose tolerance test does is it gives you glucose syrup basically and it's 100gms of glucose in water. 100gms of glucose is about 400 calories so pure 400 calories of sugar, that's a lot of sugar. And then they measure what does your body do over the next five hours. Here the lines at the very bottom show the minimum end of normal. Basically these people started out, went up a little over 100 and then came down. This is not normal; this is on glucose syrup not normal food.

The max people went a little bit above 150, maybe 160 and came back down, very similar to what we found on the other chart. When they did this with diabetics, the diabetics had different ranges depending on whether they were mild, severe or a combination of hypoglycemia and diabetes. On this pink line here if we follow that one, that's somebody who has a mild case of diabetes.

Notice, it's not that much different than the 'normal' people at the max level. The difference is that it goes a little bit higher; it starts out a little bit higher (fasting blood sugars are high in a diabetic) and then it stays elevated longer before it comes back down. In a severe diabetic, you'll see that they start out with fasting glucose that's very high and as soon as they eat this sugar solution their sugars go really, really high.

But they don't go that much above where they started. It's 50 points compared to where they go to and at about that time everybody else is peaking, but they continue and continue and continue. Even three hours later they are peaking and they are very, very, very high. These are people who are diabetic; they are not able to handle sugar at all.

Then we have the interesting case, which is the red one line. The red line is **someone who has diabetes and hypoglycemia**. Their sugars start on the higher side, they peak over 200, and then they drop down and they are going down at a similar rate to where everybody else is right around the two-hour mark, but look what happens if you follow them out. When you get to three hours they are *below the baseline* of the minimum person and then when you keep going out they continue to go down.

This is why it's important when you are testing foods the first time through, if you want to get a really good sense of what they are doing in your body, is that you test all the way out to five hours.

This is a "**Normal**" **Minimum Curve** according to Seale Harris who was one of the very first people to ever talk about insulin resistance in the medical literature, this was back in the '30s. But this is where he felt was the normal minimum curve and this was the ideal because everything is really in good shape and we've got good reserves; so you basically start out at 80 and you peak at 105 and come back to 80 and that's what we are striving for here.

This is the "**Normal**" **Maximum Curve** according to him and way back when I guess they were saying a fasting blood sugar of 120 was okay, was still within the normal.



Now we are saying that it's not and really **95 is the max and 100 at the outset** is what is **accepted as normal**. A normal blood fasting is considered somewhere around 100 and once you get above 110 you are a candidate for possible diabetes intervention.

But he's saying around 120 and they go up to 160 at peak and then they are coming down. This is what they are considering a normal curve, but we don't really consider it normal. Also because you are producing a lot of insulin, the baseline comes down below the normal so it's almost like this person is a little bit insulin-resistant and is having a little bit of hypoglycemia type responses although it's not true hypoglycemia because it doesn't get really low, but it's that kind of response.

This is someone who is **Pre-Hypoglycemia** so watch what's happening here. Start out at 90, that's good, jump up to 115 pretty quickly, go up to 140 which is too high, come back to 100 at two hours, at 85 at three which is close enough to the starting point that I wouldn't be getting upset about it but then at four hours it goes down to 80 which is 10 points below.

Five hours it goes down to 70 so it goes down to 20 points below where it started at the fifth to sixth hour. Again, this is why if you give a three-hour test you don't really catch it. You may think that the food is good for you, that you are responding well to it and it may actually be triggering this response.

This is somebody with **Mild Hypoglycemia**—the other one was borderline this is mild—they go from 80 to 120 and very quickly it's starting to come back down, back at 80 at one hour, 60 at two hours and then they jump back up to 80, 75, 80 so really just having a little bit of a dip at two hours. Again if you are not careful at monitoring you are not going to catch this.

Severe Hypoglycemia, looks what happens here, 95 up to 110, up to 120, back down to 105, 100 but at four hours they are at 60, at five hours they dip down to 40 and at six hours they are still at 60. This is very severe hypoglycemia and they are going to feel really, really bad in this range.

Now we get a sense of what normal glucose curves look like. Unfortunately, we don't have an easy way to test insulin at home the way we do with glucose. However normally if you look at that first chart we saw that insulin and glucose usually rises at pretty much the same rate so it's pretty easy to predict if your glucose is going up your insulin is going up, but not necessarily.

There have been a number of studies that show that there are some foods that raise insulin without raising your glucose. And remember when you raise insulin you are bathing your cells in lots of extra insulin for long periods of time and they run the risk of becoming insulin resistant and also developing inflammation and in the case of the vessels, stiffening and hardening of the arteries.



Here are some of the things that they found, **that Some Foods Don't Raise Glucose But Increase Insulin.** *Dairy products* produce high insulin responses even though they have a low glycemic index meaning they don't raise the glucose very much. Insulin's response to milk isn't just due to the lactose, which is the milk sugar, that's what they originally thought. But the rise in insulin is disproportionate to the amount of lactose in there.

What they found is that there are amino acids, leucine, valine, lysine and isoleucine that are insulinogenic, which means they cause rises in insulin. These amino acids are highest in whey protein, in the whey part of the dairy product.

That's why when people ask me 'can I take whey protein during this program?' 'Is whey protein a good protein to take?' I don't think it's a good thing to take if you are insulin resistant or developing that or looking to prevent that. Protein-rich foods and foods rich in fat and refined carbohydrates seem to elicit responses that were higher than their glycemic responses.

Some of the foods that did this were lentils, which are high in protein and carbohydrates, eggs, and fish, which is high in omega 3 fats, they were some of the unexpected results of this. But **when you mixed protein-rich foods with carbohydrate foods then it elicited insulin responses that were even higher than normal.** It's mixing protein-rich foods with carbohydrate-rich foods that can stimulate insulin secretion without increasing your blood sugar so it's interesting how all this works.

Here's a chart, it's in your documents. This chart shows the results of the study so there's a lot of scientific jargon, if you get overwhelmed with that just bear with me, don't look at it.

The bottom line is when you look at these foods you look at the glucose score and insulin score: white bread is considered 100% and everything else is compared to white bread. You'll see that in the carbohydrate foods it's pretty much proportional, the insulin score is just a little bit below the glucose score in all of these, so that's what you would expect.

The same thing is true in your carbohydrate-rich foods. They did breakfast cereals and breads and grains, same thing, very, very similar.

But if you look at things like the protein-rich foods some of them have a fairly significant insulin score even though they don't have a high glucose score. Like here, like fish has a very low glucose score of 28 and has a high insulin score of 59.

Here's a chart that I put together from the information. You'll have a copy of this, the full version of it. So we are basically looking at 240-calorie portions of these foods and some of these cases we know what the sizes of those portions are, otherwise we'd have to calculate it. But there are 240 calories-per-portion; here's the amount of carbohydrates in there and when you look at 36g of carbohydrates, you would expect that with oatmeal.



Its glycemic index is 60 but its insulin index is only 40 and it turns out that oatmeal actually has some components in it that help with your insulin sensitivity. All Bran has a little bit of that as well and Muesli has little of that as well, so some of these foods actually cause a little bit less insulin because they have some things that help with the insulin response, but most of them are pretty predictable. It's not just related to the amount of carbohydrates although it's pretty predictable in these foods.

What's The Effect Of Fat And Protein On Your Glucose And Insulin? As we said before, milk proteins cause your insulin to rise and the whey fraction contains the most insulin-secreting chemicals so it's a good idea to stay off the milk and stay off the whey.

Protein-rich foods when added to a carbohydrate-rich meal stimulate insulin secretion without increasing blood sugar. A lot of times people will say I can eat my bread, it doesn't raise my glucose and it doesn't cause me to feel weird if I eat it with protein or if I eat it with fats. Some people have found that if they take a smoothie that has a bunch of fruit in it, it raises their sugar. If they add fat to it then they don't have the same response, their sugars don't go up as high. However, their insulin might be going up, it's likely that they are going up until you reset this whole system and you get things working properly again.

The bottom line is that we want to stay away from things that cause excess insulin and usually we can detect that by looking at our sugar charts but not necessarily.

In addition to avoid things that obviously cause your insulin curve to go whacky it's a good idea to avoid milk and whey proteins, and then avoid having carbohydrate-rich meals with concentrated protein sources. For example having fruit and nuts, or fruit and beans, or fruit and meat, or baked goods and all things like that are not good combinations. It's a good idea to avoid milk and whey protein to avoid this insulin-stimulating effect; but also avoid the protein-rich foods mixed with carbohydrate-rich meals because they can stimulate the secretion of insulin and you wouldn't even know it because your blood sugar isn't going up.

Some combinations that are culprits: fruit with a piece of steak, fruit with beans or tofu, or fruit and nuts is a hard combination and they trigger some responses. Because for two reasons with nuts, it's a little bit high in protein compared to green vegetables, but it's also high in fat.

A large amount of fat added to a carbohydrate-rich meal increases the insulin secretion even though glucose is reduced so this is a catch-22. If you eat one of these fancy raw foods bars that's loaded with fruits and nuts, or you throw avocado in a tropical fruit smoothie, it could be creating high-insulin levels for you.

When you put too much insulin, when you induce high insulin in people, experimentally over 48 to 72 hours it could create insulin resistance even in healthy subjects. That's kind of interesting, *it's only 48 to 72 hours that you may be starting to stimulate a high insulin response and insulin resistance.*



Down below are the studies where this came from and there's a link so you can look them up. Basically the conclusion is that since food proteins differ in their capacity to stimulate insulin release and possibly by affecting the early release of specific hormones, incretin hormones and insulinotropic amino acids, this may be the mechanism by which they are working. Milk proteins cause insulin to go high, the whey protein has the most effect.

We've been checking our fasting glucose and also our postprandial, after-meal glucoses and hopefully after exercise as well. There are a few **Other Tests To Determine Risks For Insulin Resistance** and whether it's transient that you're experiencing, or if you have more of the makeup for it.

Basically **fasting glucose ideally 80-95** it might even more ideal 75-90 is what the research is saying. **Triglycerides** you want to keep them in the **range of 50-100**, I like to keep them around 75, that's a good level for it. **HDL**, which is your High-Density Lipoprotein, those could kind of get as high as you need them to get. But if they get **too low** that's a surefire **sign of insulin resistance**.

Your **ideal insulin levels** are **between 2 and 5** and your ideal **triglycerides** is under 100 but **over 100** is what you would expect **in insulin resistance** certainly. The other thing that I recommend you do if you've been doing your fasting glucoses and your food glucoses and you've been finding any abnormalities, you may want to get a test called **Hemoglobin A1C** and see where that is. That will give you kind of an average of what your glucose has been ranging over the last three months and what that average does is give you a good sense of how your glucose control has been and if you need to tighten it up. So it's a little test, you can do it at home it's a little bit more challenging and expensive than the glucose test because you have to get this little unit and you stick in these little cartridges in it. It costs about \$17 per test unless you buy 10 of them at a time in which case it goes down. You can get them on Amazon. But it's a good idea to test, you certainly can a month initially just to see if your dietary changes are working. But once they kick in you should not have to be testing on a regular basis.

It's a good test to do; it tests for glycosylated hemoglobin. Hemoglobin is the oxygen-supplying cells in your blood and when they get exposed to too much insulin and sugars they tend to stiffen and they get what's called glycosylated so your circulating blood cells get stiffened and hardened and filled with sugar basically.

Let's start with what is a normal A1C and a **normal A1C is usually between 4.6% and 5.4%**. Further down here it shows you how to calculate an A1C of 5.1% is an average of 100mg/dl (5.6 mmol/L) that you are maintaining. If you are maintaining an average of 100 that means that you are having some higher spikes than that, that's about as high as you'll want to go. If you are eating all day long then you are probably bumping this up in increments.

Heart attack risk is in a straight-line fashion as soon as A1C starts to rise above 4.6, you start to increase your risk of heart disease.



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It really is a good idea to keep your A1Cs to 4.6 or below. Bottom line, you've got this normal glucose curve, you want to strive to be at the low end, you want to strive to have your peak be nowhere more than 110 during this program but ideally no more than 100 to keep the exposure to having your blood vessels to be normal. So study these charts, compare these charts to your own and this should make a whole lot more sense. This is Dr. Ritamarie, thank you.