The American Diabetes Association describes type 2 diabetes as a chronic condition that you have to live with...

"*One of the themes that's coming across is once you have diabetes it is such a hard disease to manage and to have treated because these are long term chronic conditions.*"

Considering that as of September 2018, A record high number of Americans—40% are living with diabetes or prediabetes, this would mean 100 million people are going to have to learn just learn to live with this disease that harms every single organ in the body.

However... British Politician Tom Watson recently made a buzz by reversing his type 2 diabetes "I really did it by just changing my diet... "They were contradicting the dudes"

Michael Mosley clip roll

And here is Dr. David Unwin presenting data on 66 diabetics who did a diet intervention for 2 years:

"*Now, of the 66 cases, 33, 50%, are in remission after 26 months!*"

Doesn't sound like type 2 diabetes has to be chronic. This video is about 6 Myths that hamper your understanding of diabetes and how to prevent or reverse it. This was **Myth #1**, that **Diabetes is a Chronic condition.**

Myth #2 - Excess calories are the key cause of weight gain and so we should monitor calories to get a handle on diabetes.

The American Diabetes Association says that because being overweight is a risk factor for diabetes, calories, but *not sugar* are what lead to diabetes. In this earlier shown talk at Harvard about the Treatment and Prevention of

diabetes, a good portion was spent discussing calories and calorie labeling:

"*The biggest impact is probably because restaurants are reformulating their menus to offer lower calorie products and they're reducing the calories in newly introduced items that are constantly coming on menus by about 60 calories or 12%. At a population level, if you can extract that number of calories out of the diet, it can actually have a pretty big impact on levels of both obesity risk and diabetes risk.*"

Calories in calories out, it's a *rule* of physics - of thermodynamics, so it is of course correct ...but when it comes to understanding weight loss, it's practically irrelevant.

Why? Because while calories can be a rule of thumb, they tell you pretty much nothing about hormones. So, let's look at the hormone you've been expecting me to talk about: Insulin.

In Chapter 4 of Robert Lustig's book "Fat Chance," he tells the story of Marie, a 16 year old who had to have a tumor in her hypothalamus destroyed with radiation, and ever since that procedure she gained 30 pounds per year, and weighed 99 kilos or 220 lbs when Dr. Lustig first saw her. "*Her insulin levels spiked to incredible heights every time she ate. She had a form of intractable weight gain due to brain damage called hypothalamic obesity.*" Dr. Lustig put her on a drug called octreotide that lowers insulin release. According to her Mom, she stops being hungry on half the amount of food, she has more energy, and lost 21kg or 48lbs in one year.

Dr. Jason Fung points out here that as early as 1921 and in the 1930's insulin was used specifically as a "fattening agent" to help chronically underweight children and pathologically underweight patients gain weight.

[Dr. Jason Fung:] "*So, here's a startling fact. I can make you fat. I can make anybody fat, how do I do that? I prescribe insulin.*"

A very clear display of insulin's fattening properties is "Lipohypertrophy" - a well known phenomenon where people who inject insulin will develop a bulb of fat at the site of injection.

[Fung]"*So, if I prescribe insulin or if I give drugs that increase insulin, you will gain weight and every doctor and every patient who takes insulin knows that already.*"

And people who have to inject insulin regularly are very familiar with the fact that insulin is fattening. There's a dangerous condition called diabulimia where type 1 diabetics wanting to lose weight will deliberately skip injections risking the serious consequences of unchecked high blood sugar.

Going back to Marie, she was less hungry and more energetic on the octreotride, so she did *end up* eating less and her resting calorie burn went up, calories in calories out happened to check out, but this was all thanks to less insulin.

This leads to another very similar myth:

"*But beating obesity will take action by all of us based on one simple common sense fact. All calories count, no matter where they come from. Including coca cola and everything else with calories.*"

Myth #3 A Calorie is a calorie

When you eat carbohydrate, especially low fiber carbs, your blood sugar or "blood glucose" goes up, and your pancreas pumps out insulin because

insulin's job is to get the glucose into the cell to be used for energy. On the other hand, eating protein elicits only a moderate release of insulin and fats elicit almost no release of insulin[R], so how can all calories be equally fattening?

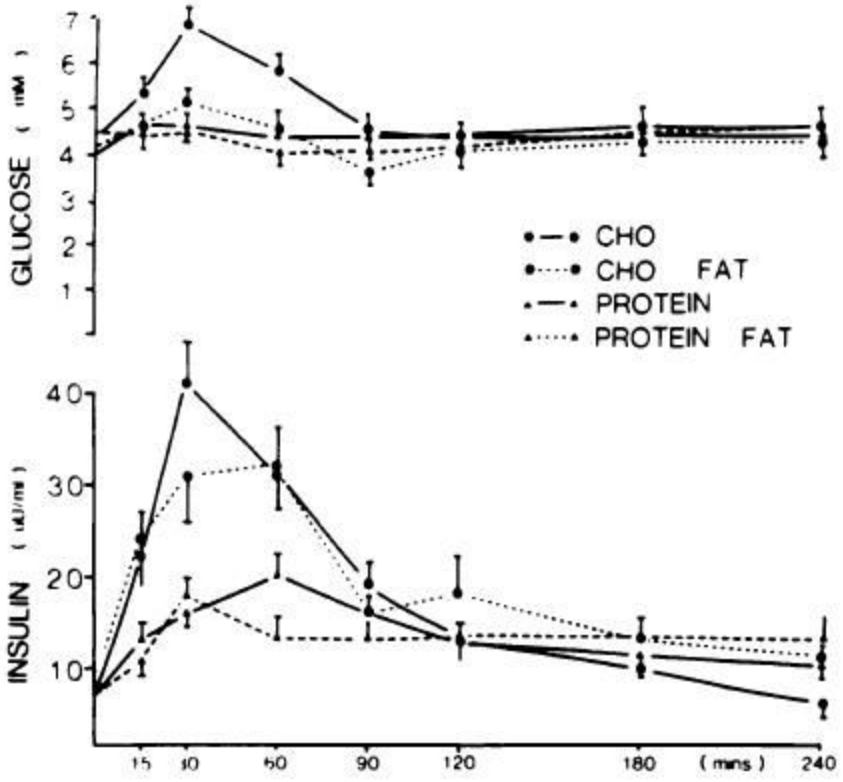


FIG 1. Plasma glucose, insulin, and GIP responses to 50 g carbohydrate ± 50 g fat and 50 g protein ± 50 g fat. Mean ± SEM (n = 8).

Keeping all this in mind by the way, what are diabetics recommended to eat?

"*General recommendations are to tell patients with type 2 diabetes to consume 40 to 65 grams of carbohydrates per meal plus more at snacks. That's a lot of carbs.*"

Ironically type 2 diabetics are often told that they need to lose weight to reduce their insulin resistance and manage their diabetes, ...but in order to keep their blood sugars in check while eating a high carbohydrate diet, they are routinely prescribed to inject insulin, a fattening agent. [Clip: *"And we use insulin, a very effective medication… there's a lot of preconceived fears about it."*]

Now, the problem with type 2 diabetes is that the cells are insulin resistant to the action of insulin, meaning they need more insulin to get the same amount of carbohydrate processed. But what is the cause of this insulin resistance ?

Insulin is a hormone, and hormones get their job done by binding *receptors* on the surface of their target cell, much like a key fitting into a lock. Insulin acts like the key, fitting into the lock on the cell to open the door for glucose to get into the cell so it can be turned into energy.

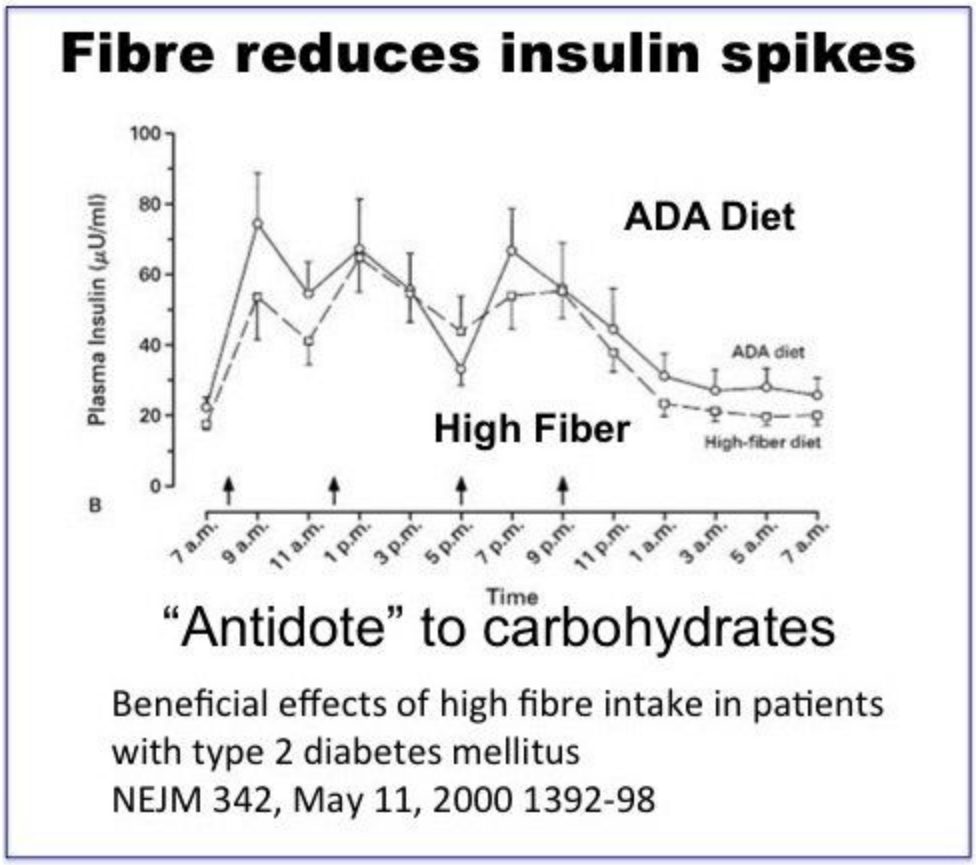
Dr. Neal Barnard uses this analogy in a TEDx talk of his to explain his theory of how insulin resistance works:

"*What if I get home, and, getting up to my front door, I take my key out of my pocket, I put it in the front door. It's not working. And there's nothing wrong with my key. But I look in the lock - somebody put chewing gum in my lock. Well, when a person has diabetes, their insulin key is not working. Why would that be? It's not that there's chewing gum inside the cell. What there is is fat. Intramyocellular lipid is fat inside your muscle cells and That is what interferes with insulin's ability to work like a key to signal glucose coming in.*"

This idea that fat from the diet is clogging up the insulin receptor leading to insulin resistance is what he's talking about within the first 10 minutes of Kip Andersen's relatively popular documentary "What the Health."

"*Ah you're driving me crazy. Diabetes is not and never was caused by eating a high carbohydrate diet and it's not caused by eating sugar. Here's the thing, if I eat a sugary cookie, the sugar lures you in like the trojan horse but waiting inside that cookie is a huge load of butter or shortening. And that's the part that leads to the diabetes, it's the fatty foods, not really so much the sugar. The cause of diabetes is a diet that builds up the amount of fat into the blood, I'm talking about a typical meat based animal based diet.*"

Now Dr. Barnard did show in 2009 that a high fiber low glycemic whole foods vegan diet had better outcomes for diabetics compared to the *conventional* recommended diabetes diet. I'm not doubting that there is benefit to be had from such a diet, but that a lot of the benefit comes from the protective effect of all that fiber in all those plant foods. Consuming carbs wrapped in a ton of fiber in the form of vegetables protects you from getting blood sugar and insulin spikes - fiber is like an antidote to the carbohydrate. Dr. Barnard's diet is also very low in fat, but that doesn't mean fat is the bad guy. Just because there's fat in the muscle of diabetics doesn't mean that dietary fat, rather than sugar, causes diabetes.



Now, Dr. Barnard is correct in that there is at least an *association* between accumulation of fat in skeletal muscle and insulin resistance.[R]

But this leaves us with two questions
The first is how did **how did the fat get in the muscle in the first place?**
Is it coming straight from the fat you eat?
Well, it depends.

There is a process where dietary fat is stored in your body as fat and this process is called re esterification. And, as this study found, high dietary fat intake has appears to increase fat in the muscle, intramyocellular lipid.

However, consider that this re-esterification process is an **insulin** facilitated process. So the fat you eat can go right to storage in the body, and some of it may end up in the muscle, but insulin, which rises when you eat

carbohydrate, is what stores the fat.

So to really test if dietary fat really is the culprit of intramyocellular lipid, you'd want to have the people doing a diet that is high fat but very low carb and therefore very low insulin. Which would be like the ketogenic diet, which has only 5% of energy coming from carbs. However, in the earlier mentioned study, "*subjects were put on a diet of (25% fat, **55% carbohydrate**, 20% protein) for three days, and then for three days they ate a high fat diet. But it was 60% fat, **20% carbohydrate**, and 20% protein.* This is not nearly ketogenic and most wouldn't even define that as "low carb." [1, 2] With 20% carbohydrate there's still plenty of insulin to shuttle dietary fat into the muscle.

So what happens when you do restrict carbohydrate *sufficiently*? This study, similar to the last one, compared a low carb and high carb diet to see which would put more fat in the muscle. Except, the low carb diet of this study was much lower carb with only 10% carbohydrate and then 60% fat and 30% protein. Their high carb diet was 60% carb, 20% fat, 20% protein. The results? This time, they found the "*High-carb diet increased fasting insulinaemia and* [fat in the muscle]."

So it depends on the context. Precise intramyocellular kinetics are not entirely clear yet, but fat isn't the bad guy it's been made out to be. It seems insulin is peer pressuring the fat to get into places we don't want it to be in like the muscle.

So this was **Myth #4, "the fat you eat is the fat you wear"** Just because you eat fat doesn't you'll store it. To correct that statement: "The fat you eat might be the fat you wear *if there is enough insulin present to make you store it."*

One other thing to consider in the second study is that the *carbohydrate could be* getting turned into fat and put in the muscle. The process of

turning carbs into fat is called de novo lipogenesis. And, it's well known that refined carbohydrates increase triglycerides and a high fat super low carbohydrate ketogenic diet results in the best *reduction* in triglycerides compared to other diets.

If you want to see fat in the muscle, by the way, look at cattle. Grain fed cattle - cattle on a high carb diet have a lot more fat marbling in their muscle than grass fed cattle on a high fat diet. The grass fed cows have barely any fat in the muscle. But they're on a grass diet, not a high fat diet… right? Actually, up to 70% of the grass fed cattle's energy requirements come from short chain fatty acids, which are produced as a result of microbial fermentation of the grass in the foregut of the cow. So they're technically on a high fat diet yet develop hardly any fat in the muscle.

So, there's still one more question. **Is fat in the muscle, however it happened to get there, gumming up the insulin receptor lock and causing insulin resistance?**

Well, some papers say fat in the muscle might be one source of insulin resistance, but others say it's not a marker of insulin resistance.

However, consider this: exercise is well known to have a beneficial effect on insulin sensitivity - this is not disputed. However, as this study found, "*exercise training increased IMCL by 21%*" but at the same time, it *improved* insulin sensitivity. This phenomenon actually has a name, it's called "athlete's paradox" "*in which endurance-trained athletes, who have enhanced insulin sensitivity, also have higher intramyocellular lipid (IMCL) content.*"

So, fat in the muscle may be *associated* insulin resistance, but it's doubtful that it's the key cause of insulin resistance by gumming up the insulin receptor lock. In any case, because dietary fat doesn't reliably increase fat

in the muscle cell regardless of the context, and simply because many people have improved insulin resistance and reversed their diabetes on a low carb or ketogenic diet, we can safely mark **the idea "Dietary fat is the cause of insulin resistance, and therefore diabetes" as Myth #5**

Then what *does* cause insulin resistance? Well, insulin causes insulin resistance just like smells cause smell resistance or alcohol causes alcohol resistance. When you first meet your girlfriend to hang out you might be able to smell her perfume very easily, but after a couple minutes you no longer notice it. If you start to drink a lot, you'll find you have to drink more to get the same effect from alcohol. Similarly If you keep getting a lot of insulin in the bloodstream, your cells will get resistant to it.

Jason Fung explains this in his book "The Diabetes Code." He says "*I can make anybody insulin resistant. All I need to do is give them enough insulin.*"

In Chapter 6, Dr. Fung presents three studies:
・One maintained a forty-hour constant insulin infusion into a group of healthy young people which increased insulin resistance by 15%.
・In another, a ninety-six-hour constant intravenous infusion of insulin into a group of healthy young people increased insulin resistance by 20 to 40 percent.
・And in the third one, patients initially not taking insulin were titrated up to a very high dose of 100 units of insulin per day. Dr. Fung says: "*The higher the insulin dose, the more insulin resistance they developed— a direct causal relationship, as inseparable as a shadow is from a body. Even as blood glucose levels got better, the diabetes was getting worse. Insulin causes insulin resistance."*

So in a high carb diet, unless it's offset with a **bunch** of fiber like in Neal Barnard's study, a vicious cycle is created where excessive carbohydrate consumption raises insulin, insulin worsens insulin resistance and fattens

you up. This insulin resistance means you'll need more insulin the next time you eat the same amount of carbohydrate, speeding up the whole cycle. Then, if you really want to accelerate this cycle, you can start injecting insulin.

This finally leads us to **Myth #6** - **You need a certain amount of carbohydrate** though, right?
Nope. Our bodies can make all the glucose we require - this is called gluconeogenesis.

"*We have essential amino acids, those proteins, essential fatty acids, but nope. No essential carb. Our minimum daily requirement for carbohydrates is zero.*"

So it seems like the simple solution to type 2 diabetes would be to restrict these insulin raising carbs. You could go on a low carb or ketogenic diet or you could *really* lower insulin by eating nothing. And of course all kinds of articles and guidelines against doing this and there's experts saying you should definitely not do a keto or low carb diet, so it's pretty confusing. Stick around because next week I'll be talking about concerns like this along with more information on diabetes itself.

I recently listened to Dr. Jason Fung's audiobook "The Diabetes Code," the content itself was very intriguing but what made it special is that it is narrated by Dr. Fung himself. It was engaging enough that I ended finishing it in a span of just two days. Dr. Fung thoroughly covers the history, epidemiology, cause and treatment of diabetes, putting complicated concepts in plain English with a bit of subtle humor here and there. He also dispels many myths surrounding diabetes and corrects several lines of incorrect education we have received regarding nutrition. If you'd like to check it out, go to www.audible.com/whativelearned or text 'whativelearned' to 500-500 to get an exclusive 30 day free trial and one free book. And now, Audible members can get even more from their subscription with 2 free Audible Originals in addition to their monthly free audiobook.