Medium | Health

Insulin resistance, fasting, and low carbohydrate diets — how it works

Exploring what insulin resistance is, and why common remedies like fasting and ketogenic diets seem to work so well

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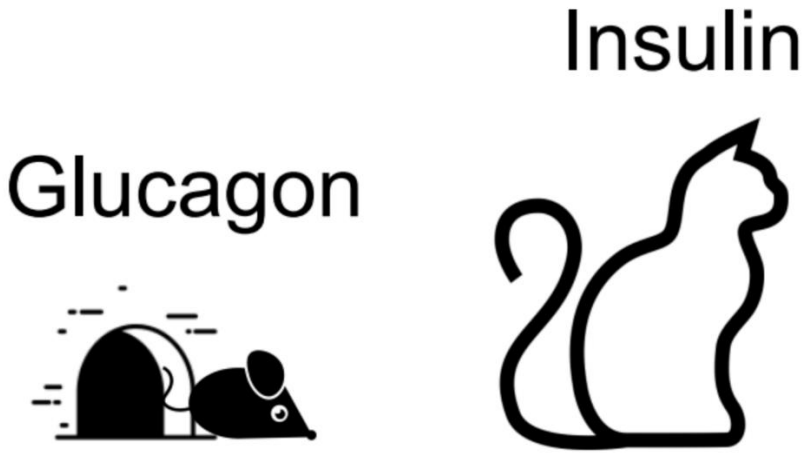
Introduction

Humans are designed to eat in short bursts, and efficiently store energy for later use. This physiological system and anatomy is an intricate network that includes various hormones (like insulin and glucagon), different organs, like the liver and adipose tissue (fat tissue), the muscles and the brain.

Insulin is the master storage hormone. Insulin is released overwhelmingly in response to sugar and carbohydrates in the diet. Insulin's job is to make sure that the energy that is contained in the meal, is stored for later use. The body cannot use all of the energy at once (it will catch on fire if it does), so it requires a system of storing the energy and incrementally using it as it is required later. Food energy is stored in the form of glycogen (minimally) and body fat, (majority).

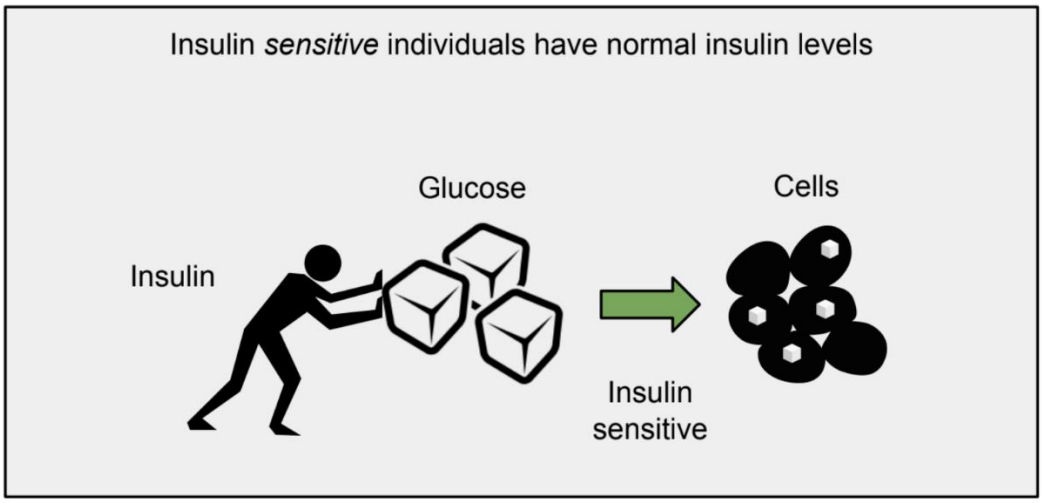


When the cat is gone, the mouse comes out to play

Once the meal has been processed, insulin will naturally start going down, under normal conditions, which allows glucagon to rise, and the body will start using the stored energy for regular functions. The hormone that determines fat burning is called glucagon and it only rises when insulin is kept low. Insulin suppresses glucagon, so in order to get glucagon to increase, we need to allow insulin to go as low as possible, for as long as possible.

Insulin sensitive individuals

When someone is insulin sensitive, this means that the body responds to sugars and carbohydrates in the diet in an appropriate manner. As the sugars enter the bloodstream, insulin is released and signals the cells to absorb glucose from the blood. This happens quickly and insulin quickly returns to normal levels.

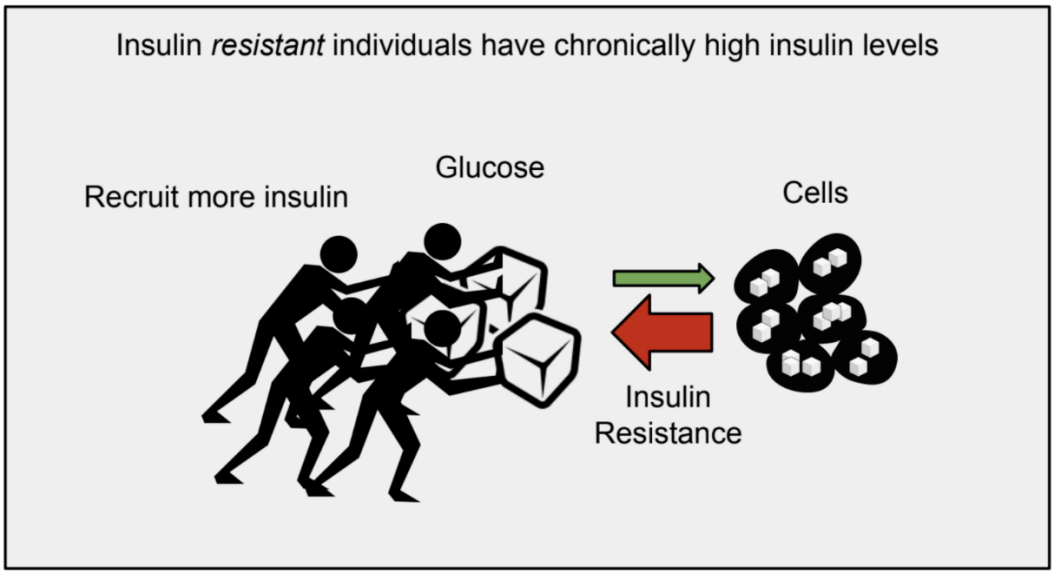


Insulin mediates the update of glucose from the bloodstream into the cells

In addition, when insulin performs the signaling function correctly, the downstream effects include appetite suppression and a normal satiety response. This downstream hormone is called leptin, and it is produced in the fat cells in response to insulin, and leptin tells the brain that it has had enough food and it needs to stop eating.

Insulin resistant individuals

Insulin resistance leads to chronic hyperinsulinemia (and chronic hyperinsulinemia causes insulin resistance), which in turn results in a physiological state of ‘always-in-storage-mode’. The impact of this is that you always feel hungry, frequently feel tired after a meal, you feel tired when you wake up and lack the energy to go out and exercise, and most importantly, this is why people struggle to lose weight.



The body recruits more insulin to force the (toxic) glucose from the blood into the cells

Insulin resistance means that the cells of the body do not respond to insulin in the correct manner. Insulin is rendered incapable of performing its regular function of signaling cells to take up glucose from the bloodstream. (Phinney and Volek 2011)

High blood glucose is severely toxic to the cells of the body, your physiology has no choice but to increase the amount of insulin it is secreting, in the hope that the cells respond by removing the glucose from circulation.

Not all cells are equally resistant in all insulin resistant persons. In some persons, the fat cells may respond, and take up the glucose and turns it into body fat. In other persons, it may be the liver, or kidneys, or the muscle cells, but it varies from person to person and this is why insulin resistance may cause weight gain in some, and high blood pressure in others, high cholesterol, brain fog and so on.

In principle, the body requires more insulin to process the same amount of carbohydrate, and insulin remains higher for longer, leaving the body perpetually in storage mode. (Tim and Sboros 2018; Cummins and Gerber 2018)

This resistance also means that the satiety hormone, leptin, is over-secreted, and the brain starts becoming deaf to its signal, meaning that the "I am full" signal does not transmit its message effectively. In response, we eat more to satisfy our hunger, and specifically, we tend to eat more foods that drive our insulin very high, in order for us to increase the loudness of the leptin message.

This also leads to frequent blood sugar "crashes", hunger and uncontrollable cravings, placing us in a perpetually high insulin physiological state.

What causes insulin resistance?

Insulin resistance has many causes. It varies from person to person, and it can be quite hard to figure out for some people. Here are a few common causes of insulin resistance.

- A diet high in *refined* carbohydrates (flour, maize, sugar, fruit-sugars, refined grains & breakfast cereals). When our cells are full of glucose, they start to push back when more sugar is added to the bloodstream and the body has to recruit more insulin to get the glucose out of the bloodstream.
- Lots of vegetable oils, the main source of polyunsaturated fatty acids (Margarine, sunflower oil, canola oil) can cause cells to start going deaf to the signal of insulin.
- Allergic responses to plant materials such as wheat and a plant substance called lectins or to dairy (yogurt, cheese, milk, cream). This reaction also makes cells deaf to the message of insulin.

Takeaways and fast foods, generally contain lots of refined carbohydrates and vegetable oils, like deep-fried chips, and donuts.

Once we start showing signs of insulin resistance, that is when we start feeling the effects of chronically high insulin levels. This is called hyperinsulinemia, and this further exacerbates insulin resistance.

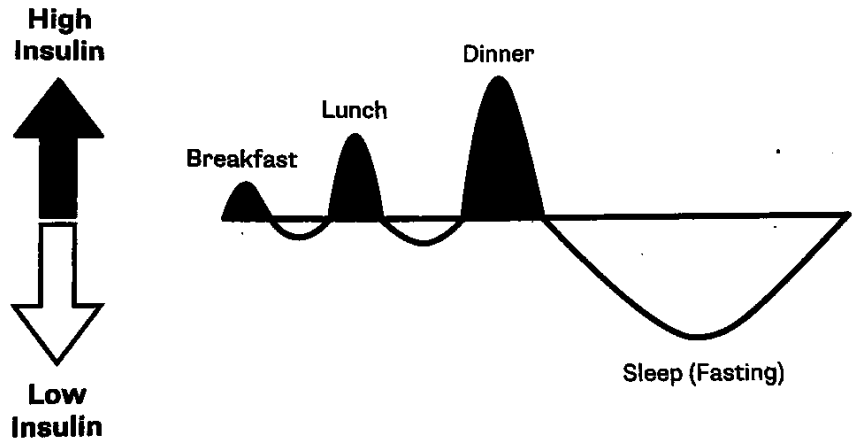
Fixing insulin resistance

Addressing insulin resistance, for most people, is a process that deals with restoring the insulin balance in their bodies.

The impact of when we eat

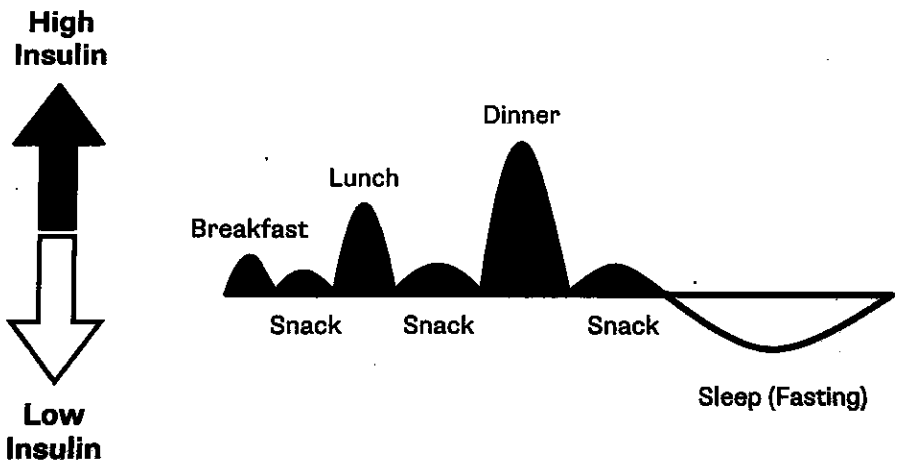
When we eat 3 regular meals per day without snacking in between, we give our body a chance to process the energy and get back to a healthy low insulin state. This has the impact of spending the majority of our day in a low insulin state, and the means that we can burn our stored body energy, we feel less hungry, and we increase our ability to concentrate for long periods of time.

Figure 10.1. Insulin release with an eating pattern of three meals, no snacks.



When we eat frequently, we increase the number of times insulin is increased and we spend more time in storage mode. This has the unfortunate (Fung and Nishii 2017)

Figure 10.2. Insulin release with an eating pattern of multiple meals and snacks.



knock on effect of keeping our body from using stored energy, which means every time that we start running low on energy, the body cannot access its stored energy, because insulin is still high, meaning that we start looking for something to eat. You often hear someone experience low blood sugar, and this is where it comes from.

The more time we spend in a low insulin state, the more insulin sensitive we will become. (Fung and Nishii 2017)

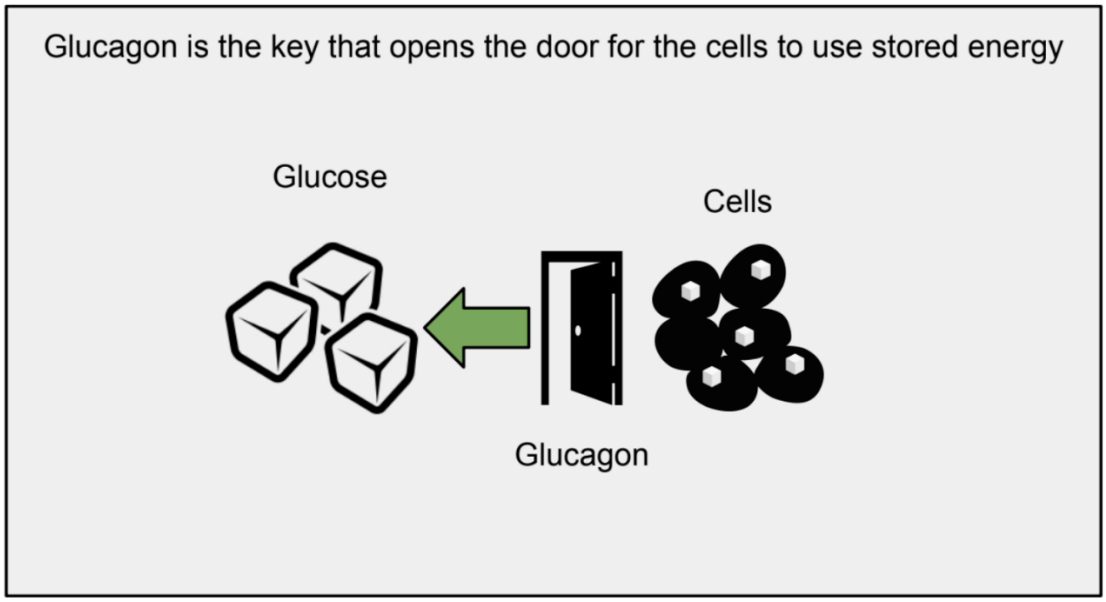
If we extend the amount of time during the day that we don't eat, and reduce the number of hours during which we eat, we allow our bodies to spend more time in a fasted state and that will allow insulin to remain low and our bodies will naturally use our stored energy without complaining of hunger. This takes a bit of time.

The impact of what we eat

Just as when we eat determines our insulin response, the kind of food we eat also determines our insulin response. Healthy fats do not increase insulin, and protein has a limited impact on insulin secretion.

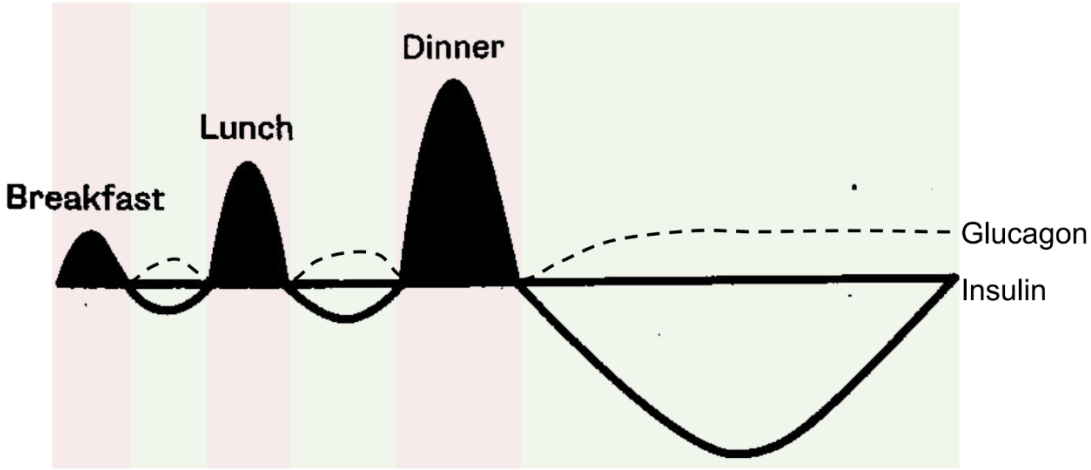
Carbohydrates, such as those found in refined carbohydrates like flour and sugar, has the biggest impact on the amount of insulin that we secrete in response to a meal. By limiting the amount of carbohydrates, specifically refined carbohydrates and sugars in our diet, the better our base-line levels of insulin will be and the more insulin sensitive we will become, or for the lucky ones, remain.

Why intermittent fasting works



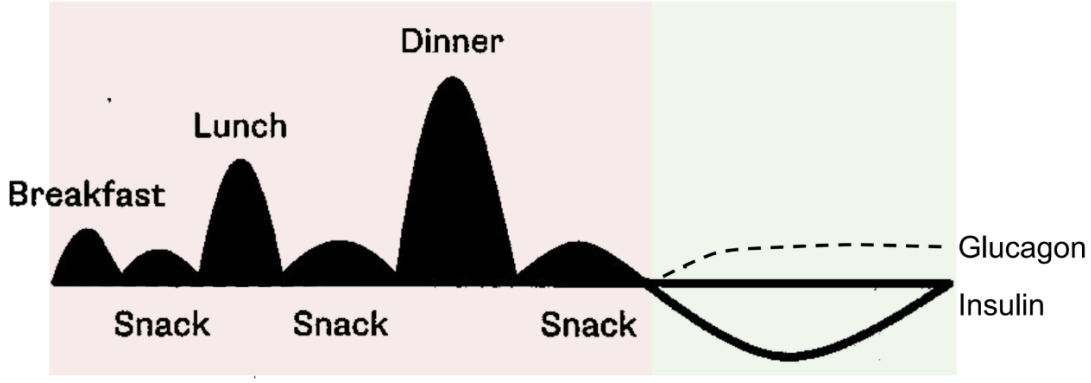
Intermittent fasting works for weight loss, and general health, because it restricts the time we spend in an insulin dominant state, to allow our bodies to use its stored energy.

As insulin starts decreasing from circulation, it allows the hormone glucagon to rise. Insulin suppresses glucagon, so when the cat (insulin) is gone, the mouse (glucagon) comes out to play. The main function of glucagon is to act as a key to unlock stored energy from the fat cells and the liver cells.



As insulin drops, glucagon rises and we start using our stored energy. The longer insulin is kept low, the more time glucagon has time to do its magic. One of the main effects of a system with high glucagon, it that it naturally suppresses hunger. That means that after some time of not eating, the body is using stored energy, and this naturally suppresses appetite. Have you ever

noticed that when you skipped breakfast, that later in the day you are not as hungry as you expected to be? This is why!



When on the other hand, we eat three meals per day and we include snacks in between, especially if we are insulin resistant, this means we are spending more time throughout the day in an insulin-dominant state, and glucagon cannot work its magic.

Why low carbohydrate diets work

For most people, insulin resistance is a slow process that develops over years or even decades. For others, it develops when they are still babies.

Once insulin resistance develops, we gradually start using more and more insulin to remove glucose from the blood after a meal. (Noakes et al. 2016)

Most carbohydrates end up in the blood as glucose and then requires insulin to push the glucose into the cells of the liver and the fat cells. If we are insulin resistant, meaning that our cells are going deaf to the instructions of insulin, we require more insulin to process the carbohydrates that we eat.

Naturally then, if we reduce the amount of sugar our body needs to process, we reduce the amount of insulin required and the body responds in a positive manner by progressively becoming sensitive to the signals of insulin again.

If we stop pouring petrol on the fire, the body has time to heal itself.

Resources

Dr. David Unwin (via Twitter @lowcarbGP https://twitter.com/lowcarbGP/status/1188825458630184961), for the concept of insulin blood glucose/sugar diagrams.

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