Intermittent fasting has gotten a lot of attention nowadays as there's so many benefits to be had from it. It helps you lose weight, helps you gain muscle and enhances your cognitive performance. Specifically, it lowers insulin- the fat storing hormone involved with diabetes, it raises human growth hormone which does everything from increasing muscle mass to making you look better and live longer, and it promotes the release of brain derived neurotrophic factor, a key hormone for growing new brain cells.

Intermittent fasting is simple, all you do is **not** eat for 16 hours of the day. But this is a radical idea for most considering we're encouraged to be eating all the time, being told things like "*breakfast is the most important meal of the day*" and "*you need to eat six small meals to lose weight.*"

Unsurprisingly hunger is the number 1 concern when it comes to fasting. So, let's take a look at how hunger works so we can better deal with it. As Tim Russ said, "*We often fear what we do not understand; our best defense is knowledge.*"

The first thing you should know is that hunger is not a simple equation of no food plus time equals more and more hunger.

In a very thorough series on fasting in his blog called "Intensive Dietary Management," Dr. Jason Fung points to a study that shows that while subjects went over 3 days without any food, the hunger hormone ghrelin gradually but continually **decreased**. He says: "*This means that patients were far LESS hungry despite not having eaten for the past 3 days. This jives perfectly with our clinical experience with patients undergoing extended fasting. They all expect to be ravenously hungry, but actually find that their hunger completely disappears.* "

Hunger is regulated by hormones like ghrelin and it comes in waves. You do not get progressively hungrier the longer you go without food- your body adapts to your REGULAR eating schedule. It knows when you usually eat,

so it comes to expect food and make you hungry around the *same time* each day.

Here's a study from the Medical University of Vienna done on subjects participating in a 33 hour fast. Notice how, despite the early morning being when people have gone the *longest* without food, ghrelin was the lowest. And, their ghrelin didn't rise more and more the longer they went without food- ghrelin rose **at their normal eating times**. And, it fell back down *even though they didn't eat anything*.

When you start fasting, it's important to know that hunger will arise and it is uncomfortable, but it will come and go. After a couple days, your hormones will adapt to your **new** eating times and you will be less and less hungry until it's no longer an issue. This is why many people say that the first 4 days are the hardest. Un-adapting and re-adapting your eating times is uncomfortable, but your body is very good at it.

I've been doing intermittent fasting with an eating window of 2 to 4 hours for the past year, and when I was first experimenting with fasting, I actually tried eating once every other day. To my surprise, after only about 6 days of this, I wasn't that hungry on the no eating day. But, like clockwork, I started to get pretty hungry on the eating day right around the usual time I would eat.

Another very interesting thing about this hormone ghrelin, is that it may be making you hungry in order to get you to take in more ***salt***. It would be very important to have a hunger for salt as salt has many very critical functions: It's needed by the heart to pump blood properly, and it's a key component in cell-to-cell communication and the optimal transmission of nerve impulses to and from organs like the heart and brain. Low salt has been shown to stunt growth, increase insulin resistance and increase uric acid levels, stimulating oxidative stress in the mitochondria leading to weight gain.

Despite all this, the standard low sodium guidelines of only 2.3g of sodium per day drastically underestimate how much salt the body really requires for **optimal** functioning. A study in the New England Journal of Medicine found that an estimated sodium intake between at least 3g and 6g per day was associated with a **lower** risk of death and cardiovascular events. In fact, actually following the low salt guidelines posed a particularly high risk to health.

And, Intermittent fasting may have you requiring even **more** salt than usual. Intermittent fasting lowers your insulin levels. This is great, and is one of the main goals of intermittent fasting, but it's often overlooked that insulin retains sodium, so the lower your insulin goes, the more sodium your kidneys secrete.[R][R2][R3] Losing a lot of sodium and other minerals can leave you feeling sluggish and hungry. Now, your body really doesn't want to lose too much sodium, so one thing it does is it actually *increases* insulin levels in an attempt to retain more sodium. A 1991 study done on 147 people found that a low salt diet significantly increased serum insulin in these people. Of course higher insulin is something you *don't want*, so let me explain more about insulin and how it affects hunger.

So when you eat, insulin goes up and, insulin helps you utilize carbohydrate for energy or stores it as glycogen, which is basically linked chains of glucose. This glycogen is stored in the liver or muscle. And when you have too much glycogen, it will be stored as fat. Now, different foods will give you a different insulin rise, fat stimulates insulin a minimal amount while fiberless carbs provoke massive rises in insulin. But the point is, insulin's job is to help you absorb and store nutrients.

Then, after about four to six hours after you eat, insulin levels will have gone down, and the glucose level in your blood starts to decrease, this prompts the pancreas to secrete glucagon. Glucagon has almost the opposite function of insulin. Insulin *stores* food energy, but glucagon *pulls*

that energy out from your glycogen stores and your fat stores. So if you're eating every two hours and getting six small meals a day, you never let glucagon do its job and your body never starts burning into your glycogen or your fat stores. Not a good strategy for losing weight. So what about hunger?

Well, let's look at this study from 1986. They found that if you inject an animal with insulin, it will **eat more**. Adding insulin **increases** appetite. If you have insulin floating around with no new glucose coming in, your blood glucose will drop, *but* insulin needs to be low for glucagon to use your fat or glycogen stores for energy. With high insulin, you have no access to your stored energy. So it makes sense for extra insulin to promote hunger as the only way you can get new energy is to eat it and raise your blood glucose.

And as you might expect, giving an animal glucagon, *reduced* food intake. **So glucagon is decreasing appetite.**

Now they also infused glucose into the animal's small intestine and it reduced food intake, so it's of course not the case that carbs don't satiate you to some extent. But if you're eating every two hours, you're constantly pumping out insulin and the levels never go low enough for glucagon to do its job. This explains why you can eat a bowl of cereal for breakfast or a huge plate of pasta for lunch and be hungry in just an hour or two. Refined carbohydrates like that will cause the body to overshoot with its insulin secretion, so even after all the carbohydrates are processed after the meal, you still have a bunch of insulin sitting around making you hungry. This overshooting with insulin also explains why if you binge eat at night, you'll wake up starving in the morning.

So after a meal, if you're patient and can go without food for more than 4 hours or so, glucagon will allow you to start running on your stored energy and you will be less hungry.

So while fasting, glucagon suppresses hunger and is helping you power the body by burning your stored glycogen and fat. Then when you run out of glycogen, you're burning primarily fat for energy and your body enters the state of ketosis. This produces a lot of ketone bodies, which your body and brain will use for fuel. It's a common misconception that the brain runs only on glucose. In 1967, George Cahill found that the brain will derive 2/3rds of its energy from ketone bodies made from fat. Though, some processes in the body still require glucose, but you don't need to **eat** that glucose - your body makes its own glucose from things like glycerol and lactate. This is called gluconeogenesis.

Earlier we saw that higher glucagon and low ghrelin during fasting will keep hunger in check. But, we can add ketone bodies to the list. There is data that show that ketone bodies like **beta hydroxybutyrate** also reduce appetite. Which isn't a surprise considering they act as an energy source for the body.

This is one of the reasons why a ketogenic or low carbohydrate diet has such great synergy with intermittent fasting. These diets will keep insulin low, and allow you to more use fat for energy, just like fasting will.

So, if you're able, I'd recommend trying to shift your diet to one that is high in *good* fat, high in fiber, high in micronutrients, moderate on protein and low in carbohydrate. You could even start eating like this *before* you begin intermittent fasting and you'll already be adapted to be getting your energy from fat so you'll have less hunger and adapt to intermittent fasting easier.

You might be wondering why I said moderate protein. Many people assume a low carb or keto diet must have a lot of protein in it, but that's not quite the case. Insulin is necessary for protein to be metabolized, so you get some insulin rise when you eat protein. But not only that, when you eat more protein than your body needs to make or repair cells, the excess will

be broken down into glucose through gluconeogenesis.

In fact, diabetics have been shown to have a 30% decrease in daily blood glucose levels just by restricting protein.

Now there's one last interesting thing about insulin and hunger - it's how it interacts with leptin, the satiety hormone. Essentially when you eat food, depending on the composition of the meal, your levels of leptin go up and you feel more satiated. But, when you have too much insulin, it reduces leptin signalling- your brain can't pick up on the leptin signal, making you less satiated.[R]

In fact, obesity which is virtually always accompanied by insulin resistance is also accompanied by leptin resistance.

So if you want to stay satiated and full of energy rather than be hungry and lethargic, you need to keep your insulin low. Lucky for you, fasting seems to be the best way to lower insulin.

So while intermittent fasting is hard for the first couple of days, it's helpful to know that your body and hormones are working in your favor, making it easier and easier. And, if you get enough salt and minerals, avoid diet drinks, and eat high fiber, moderate protein and low carbohydrate then you can make the whole process smoother.