

Fasting 101

Fasting- The science

Fasting, by definition, is the state of your body being absent from absorbing sugar from food. When food is digested, it is absorbed by the body as nutrients (vitamins, minerals, amino acids, etc.) and glucose (aka sugar), which is used as fuel/energy for the body. During a fasting state, the glucose from the food is depleted and your body will begin to use up stored glucose to provide energy (usually stored in liver and muscles). After some time, the body will have used up all the glucose (sugar) storage from the liver and muscles and will begin to burn your fat into a “glucose” product, into energy.

“Starvation” occurs when your body is so depleted of the glucose energy storage, that it begins to breakdown protein amino acids (i.e. muscle). This takes more than a few days of fasting to occur and will also be seen when there is a lack of essential nutrients that the body needs. This leads to muscle wasting, bone break down, hormone dysregulation and much more.

The body recognizes the levels of glucose (sugar) through different signaling receptors and hormones.

What a lot of the research is suggesting, is that the body responds better to these signaling receptors and hormones in a state of fast, resulting in a better utilization of glucose in the body.

I’m going to talk to a few key mechanisms the body goes through in response to a fasting state.

1. Repair

The first response is about repairing, called AUTOPHAGY

‘Auto’ meaning self, and ‘phagein’ meaning, to eat, is when the body on a subcellular level eats itself. This is a mechanism the body goes through as maintenance to remove damaged and old “biological machinery” (i.e. organelles, proteins and cell membranes) within a cell and regrow new machinery (via a hormone called Growth hormone, which we will get into later on).

The activation of autophagy only occurs when there is nutrient deprivation (aka depleted sugar storage).

Taking it one step further, the nutrient deprivation is recognized by the cell via a hormone called glucagon, which is the opposite of insulin, found in a fasting state to

Fasting 101

tell the body to start using up its stored energy or start using and removing damaged parts (“eating itself”- autophagy) and “cleansing itself”. Autophagy is extremely sensitive to glucose, insulin and protein and will stop immediately from the smallest amounts.

After a meal, your body starts to digest food into glucose (sugar) and this sugar circulates in the blood and is taken up into the cells by the commonly known hormone, insulin. When there is excess, glucose will travel to liver be stored for survival as fuel and released gradually when needed. This fuel gets stored as two main sources; glycogen and triglycerides. *Glycogen* specifically formed from carbohydrates and is more readily available, it also offers less energy. *Triglycerides* is more complex and compact (smaller = takes up less room in the liver) and comes from fats, proteins and carbohydrates, they also offer more energy.

The process of energy is as follows → consumption of carbohydrates → turns into glucose in the blood (immediate energy source) → excess glucose will lead into a pathway to produce glycogen (next source of energy, carbohydrate based) → excess glucose (or decreased need for glycogen and glucose) then leads to a pathway with fat and turns into triglycerides (which is more locked up then the previous and is used as fuel after the previous is used up, regulates cholesterol).

When your liver is working optimally, it will store the right amount of each and be able to buffer when we eat (fuel) a little bit more or a little bit less than what is needed. However, with excess (ie over consumption of foods, stress, and environmental toxins), our liver gets clogged it will get congested with triglycerides which will turn into adipose (or fat). This can lead to many chronic disease states and slowing down your metabolism. Perfect examples of chronic diseases like diabetes (lack of insulin or insulin resistance), PCOS (impacted through insulin receptors) and NAFLD (Non-alcoholic fatty liver disease- which essentially is a fatty liver resulting from excessive glucose consumption and insulin resistance)

Meaning, the more often you are eating, the more often your body will be using insulin and clogging your liver with triglycerides. I know many people think that eating every 2 hours will keep your metabolism going but in-fact, if you are constantly eating or over eating, insulin is constantly pumping through the body, overcrowding, and the receptors for insulin (regulated by IGF-1) will become desensitized to sugar in the body.

Fasting 101

Think of this as a caretaker role in a school. Generally, caretakers come in after the students have left for maintenance. The repair and cleanup is easier for the caretaker to see ('recognize') damages and clean up (cleanse, repair and regrow) without children getting in the way (constant glucose and inflammation), so that the next day, things can be fully functional.

If there is a continuous/overconsumption, the body will be in a state of constant inflammation and won't have time to repair. This will keep accumulating damaged

cell products, and glucose, which can result in obesity, plaque in arteries, accumulation of bad proteins (seen in Alzheimer's and cancer), decreased immunity, inflammatory conditions (i.e. Arthritis, IBS) etc.

A new study from Harvard researchers has now shown that by altering the activity of mitochondrial networks inside our cells (subcellular components), can increase lifespan, slow aging and improve health. Again, if the mitochondria (housing for the production of energy) is damaged and old, the autophagy mechanism can rejuvenate it, decreasing inflammation and free radicals throughout the cell, promoting healthy ageing and longevity.ⁱ

Of course, life is about balance, and too much autophagy will make you sick. Feasting to get nutrients and help build cells and tissue is just as important as the fasting. We need an adequate amount of proteins, lipids and carbohydrates with the proper micronutrients to have optimal health. In fact, you need glycogen to kick start your metabolism and burn fat. For more insight on this please see Glucose, glycogen and triglycerides are important for liver health and energy or cell survival. Glucose gets used up quickly as it is the first source of energy. As glycogen is stored but more loosely than triglycerides, it will get used up next and is needed to use triglycerides as fuel (ie kick start burning fat). This is why resistant starches and more complex carbohydrates are important and why ketogenic diets do not provide long-term result. **For more insight on this please email us below for the download "kick starting your waist loss"**

Efficacy

As stated, when you are constantly feeding, your cells become desensitized. Dr. Valter Longo, a Professor in Biological Science, who has studied the effects of fasting on longevity and cancer, explains how fasting allows healthy cells to become more stress resistant. The cells will learn to use their energy more efficiently and effectively, (i.e. budgeting between protective mechanisms and reproduction/growth).ⁱⁱ

"When you starve, the system tries to save energy, and one of the things it can do to save energy is to recycle a lot of the immune cells that are not needed, especially those that may be damaged,"

Fasting 101

Biologically speaking, organisms only respond to necessities of life, usually in the form of hunger, pain or pleasure. They will only work, if they have to. Fasting alerts the body that it is in a need and kicks it into productivity and prepares them to confront stress.

Balance - Satiety

Two main hormones in the body produce appetite and a feeling of satiety, these are called *ghrelin* and *leptin*.

When the body is in a state of fast, a hormone from the stomach called ghrelin, acts as the hunger hormone (this hormone provides your appetite). Ghrelin stimulates the release of growth hormone, which as stated, helps in the repair of cells and tissues; Fasting responds with lower levels of IGF-1 (regulates GH and insulin receptors), lowers levels of glucose and inflammatory cytokines and increases in ketone bodies, which are molecules sent to the brain to use as energy during times of starvation. This has shown benefits to diabetes and degenerative disease. Ghrelin is balanced out (or suppressed) when leptin levels are high. Leptin is the key satiety hormone.

Leptin is your body's own fuel thermostat. After a meal is digested and absorbed, fat cells (which have taken in its nutrients), send signals to your brain to notify it that there is sufficient energy and the feeling of satiety begins. When the energy threshold goes below this level, the feeling of hunger is signaled and ghrelin is no longer suppressed. Leptin is known to be a more long-term regulation of energy, where ghrelin is short-term and effected by the intake of food.

Many studies have found that ghrelin levels are reduced in the obese population (and consequently GH) and leptin is increased, desensitizing the effects of leptin. Fasting allows for the signaling and balancing of brain-gut pathways and glucose levels, to be better conducted. ⁱⁱⁱ

Benefits:

1. Detoxification: removal of waste and maintenance
2. Immune: Improvement and rejuvenation of the immune system
3. Anti-cancer: Cancer fighting properties
4. Weight loss and diabetes: Decreasing fat tissue (ketosis) and glucose markers
5. Repair: Decreasing oxidative stress, regenerating markers and healthy stem cells
6. Longevity/Survival: Increased signaling and efficacy
7. Mental health: Fasting promotes higher level of endorphin (alerting that stress hormone) in your blood which will cause you to be more alert and, weirdly, giving you a feeling of mental well being

Fasting 101

Detoxification component of fasting:

As talked about above, maintenance is a detox of fasting. Another way the body detoxes from toxins is through the use of fat as energy. Most toxins are stored in what is known as adipose tissue (aka fat), and as fat burns, detoxification begins. When fat becomes immobilized, the toxins begin to move from these storages and filter out of the body. This is one of the reasons why hydration of water is key during a fast as it helps flush these toxins. Generally speaking, glucose storage (of the liver and muscle) is used up typically around 10-12 hours of fasting and fat storage will begin to be used as energy.

Things such as water and certain supplements and herbs (ie. Milk thistle) may help with detoxification process. Water helps move and flush things out as well as provide a balance throughout the body to prevent you from feeling bad throughout the detox.

Hydration is key:

Your kidneys are where filtration of waste products begin. The kidney's wall have layers tiny holes that vary in size and mesh-like lining for different nutrients and minerals (such as sodium, potassium, glucose, protein), waste products (such as urea) and water to move in and out depending on what the body needs. This in turn effects the body's feedback mechanism to maintain blood pressure, heart rate and other mechanisms. So if you are not staying hydrated especially during a fast, the kidney will detect the dehydration levels and try and compensate, leading to levels of dizziness, increased heart rate, drowsiness, headaches, confusion etc.

Things to be mindful about:

Fasting is a 'stress' on the body. It can disrupt sleep, increase stress levels and promote headaches, lethargy etc.

Fasting can also induce heartburn; lack of food causes a lower level of stomach acid, causing reflux and/or trigger the brain to compensate by producing an increase of acid and consequently heartburn. This is where guidance from a Naturopathic Doctor is important.

ⁱ Dietary Restriction and AMPK Increase Lifespan via Mitochondrial Network and Peroxisome Remodeling

ⁱⁱ Longo VD, Fontana L. Calorie restriction and cancer prevention: metabolic and molecular mechanisms

ⁱⁱⁱ The role of leptin and ghrelin in the regulation of food intake and body weight in humans: a review **Gh and Igf-1 Physiology in Childhood Kavitha S Rozario, Catrin Lloyd, and Fiona Ryan.**