THE SCIENCE BEHIND

WEIGHT LOSS

BASIC PHYSIOLOGY AND COMMON QUESTIONS

btc | THE BODY **TRANSFORMATION** COACH

Introduction

Weight loss is seemingly really simple - eat less and move more.

While that may be true to a degree, what goes underneath the hood is a really complex physiological process.

We think that understanding the whole process and science behind fat loss might help you successfully complete your weight loss journey.

After we explain the physiological processes, we'll give you the answers to a few common questions.

What IS Fat?

Fat deposits are usually divided into two types: subcutaneous and visceral.

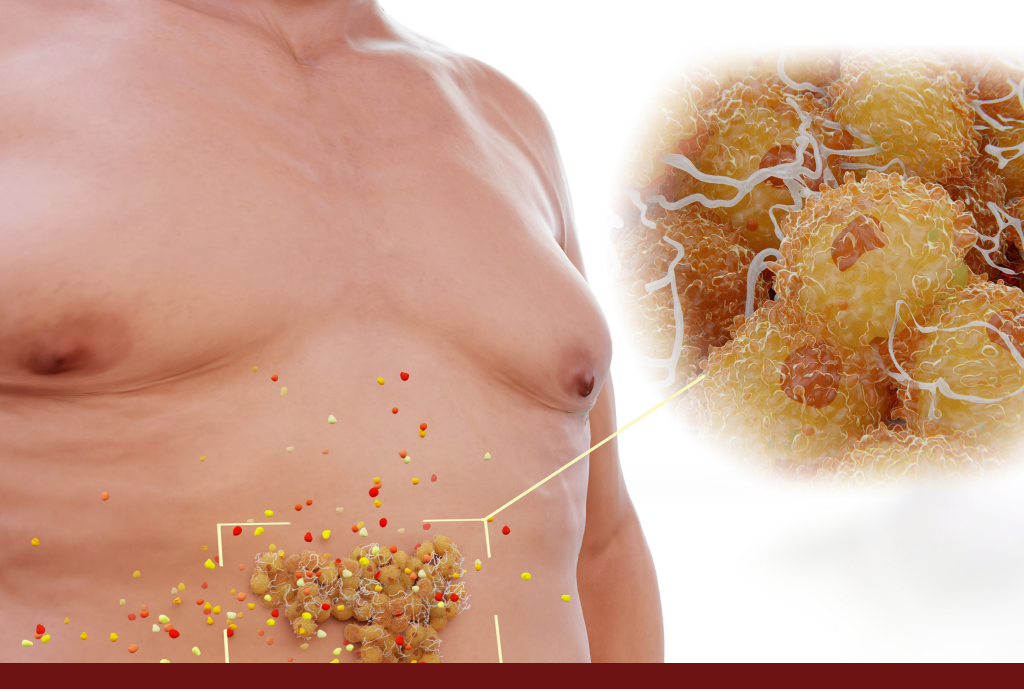
Subcutaneous fat represents the fat deposits found underneath our skin, while the fat deposits around our abdominal organs are called visceral fat.

Visceral fat is metabolically active, producing certain molecules that cause inflammation in the body.

Fat is distributed differently in men and women.

Men carry more fat around their abdominal area, whereas women usually hold more weight around their hip and thigh area. Women generally also have a higher body fat percentage than males.

This difference is caused mainly by the difference in the amounts of sex hormones that both genders produce. Men produce more testosterone, while women have more estrogen.



Although demonised in pop culture, fat plays a huge role in maintaining a healthy body. It insulates and protects our bodies, provides energy, produces certain hormones, carries fat-soluble vitamins, and much more.

Fat tissue is split into two types of tissue: brown and white fat.

Brown fat cells are smaller and are rich in iron. When it burns, it produces heat without any shivering. This process is known as thermogenesis. Adults don't have large amounts of brown fat; that's why we will focus on white fat.

White fat cells are bigger than brown fat cells. They keep us warm by providing insulation, and we store a lot more of them than we do brown fat. They are also used for energy production and protection as a mechanical cushion.

How Do We Gain Fat?

We store our fat in adipose tissue, a form of connective tissue. It's made from fat calls, which are called adipocytes, and are separated by elastic and collagenous fibers.

Technically speaking, we can gain fat in two distinct ways:

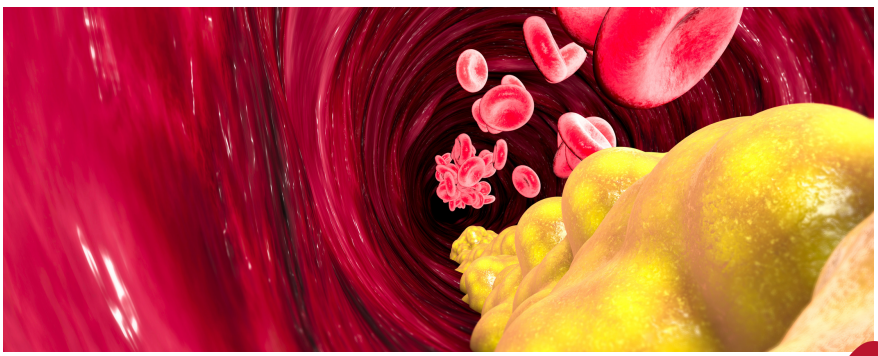
Hypertrophy:
this means that the pre-existing fat cells increase in size.

Hyperplasia:
this means that we form new fat cells.

We used to think that hyperplasia only occurs until we reach puberty, but current evidence suggests that we can increase the number of our fat cells at any age.

The exact mechanism of hyperplasia is unknown, but our best guess is that the fat cells reach their capacity and then get forced to make new ones.

The important thing to remember is that while we can produce new fat cells, we can't destroy the ones that already exist. Fat loss occurs when the pre-existing fat cells shrink in size.

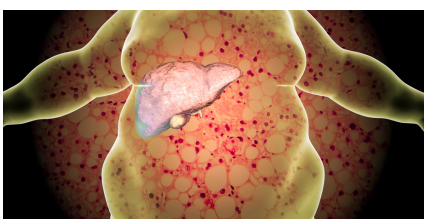


How Is Fat Stored?

Fat metabolism starts in the intestine, where the fat (triglycerides) you ingest will be broken down into smaller fatty acids.

Fat molecules are hydrophobic, meaning they don't dissolve in water and instead form tiny fat droplets with other fat molecules. This problem is because we need to dissolve the fat into smaller pieces. That's why your intestinal cells release a hormone called cholecystokinin, or CKK, in your small intestines. It stimulates the release of pancreatic lipase and bile salts. It also notifies our brain that we aren't hungry anymore.

Triglycerides are emulsified by bile salts and broken down by enzymes produced by the liver called pancreatic lipases. This basically means that the bile salts allow the fat droplets to dissolve.



The broken-down triglycerides then form free fatty acids, which are now small enough to be transported via the intestinal membrane.

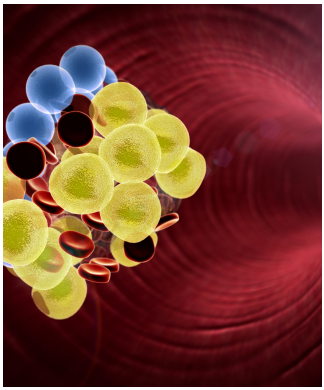
However, as soon as they cross the membrane, they again form triglycerides.

They are then packaged with a carrier molecule called a lipoprotein. The lipoproteins used in this case are called chylomicrons, allowing cholesterol and fats to move within the circulatory and lymphatic systems.

Since the packaged molecules are too big to get into the bloodstream immediately, they get into the lymphatic system. Then, after a long ride through the lymph, veins, and arteries, they arrive at the capillaries.

Finally, once they reach the capillaries, they can either be stored in fat (adipose) tissue or go to the liver.

How Do We Burn Fat?

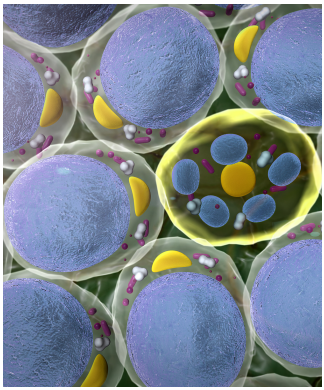


We get energy from adipose tissue through three different stages.

The first stage is called lipolysis, which occurs in the cytoplasm. We must again break down the triglycerides into fatty acids and glycerol with a lipoprotein lipase. These lipases get activated by hormones such as glucagon, epinephrine, and growth hormone.

The second stage is the mobilization of the fatty acids. They get transported to the cell by a protein called serum albumin.

The last stage is called beta-oxidation. In this phase, the fatty acids get converted into usable energy. Because fatty acids can't get to the mitochondria by themselves, carnitine helps us transfer them.



Mitochondria is the place where ATP is produced. ATP is our body's main currency of energy, and we use it for every movement we make.

The calories that we burn end up in the air we exhale or in other bodily byproducts such as urine and sweat.

Fat Burned During Rest

The Resting Metabolic Rate (RMR) and Basal Metabolic Rate (BMR) represent the energy we spend during rest, meaning the minimum amount of energy we need to sustain our vital functions.

The most significant percentage of our overall RMR is spent on the liver, kidneys, heart, and brain. Even though they combine for around 5% of our body weight, they consume approximately 60% of our RMR.

RMR accounts for 60 to 70% of our Total Energy Expenditure (TEE), which represents the total amount of calories we burn daily. TEE also includes thermogenesis and energy expedited while working out.

BMR is most accurately measured with direct calorimetry, but since that's a test done in labs and we usually don't have casual access to it, we can use calculations based on body weight, height, and age.

At rest, an average person consumes about 3.5 milliliters of oxygen per 1 kg of body weight per minute, which translates to 1 kcal per kg of body weight per hour. This rate is expressed as 1 metabolic equivalent or MET for short.

MET was first derived from testing the resting oxygen consumption of a 70kg, 40-year-old man and is now used as a concept for expressing the energy expenditure during physical activity. It was developed to standardize the intensity of physical activity, not accurately predict the energy cost during physical activity.

Since we don't have high energy demands during rest, and fat metabolism is the slowest way of getting energy, we burn about 85% of our calories at rest from fat tissue.

Fat Burned During Everyday Activity

NEAT, or Non-Exercise Activity Thermogenesis, represents the amount of energy burned during our daily, regular activities. This includes everything that's neither planned exercise nor sleeping, breathing, digestion, etc.

You can increase your body's NEAT by just moving around more. For example, playing with the kids, walking more, standing instead of sitting more frequently, cycling to work, etc.

Fat Burned When Weightlifting

Lifting weights is mostly a high-intensity activity, meaning we usually get most of the energy from carbs stored in the muscles and liver.

We can burn more fat when lifting weights by incorporating methods to make the sets last longer or increase the density of the workout.
These include supersets, circuit training, decreasing the rest intervals, doing more reps, etc.

Fat Burned During Aerobic Training

The name itself tells us everything we need to know.

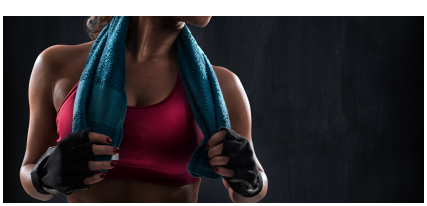
The aerobic energy system primarily uses fat as a source of energy, which is much slower than using carbs and protein but produces much more ATP.

For the aerobic system to make energy, we need to have enough oxygen available- unlike the anaerobic energy system.

The Afterburn Effect

Also known as Excess Post-Exercise Oxygen Consumption, or EPOC, refers to the body's need to restore its oxygen after a workout.

HIIT workouts usually utilise energy systems that don't require a lot of oxygen, which means our bodies need to work harder to restore their resting metabolism after exercising.



After a workout, your metabolism stays elevated, and it takes some time for it to return to baseline, and that's where the afterburn effect occurs.

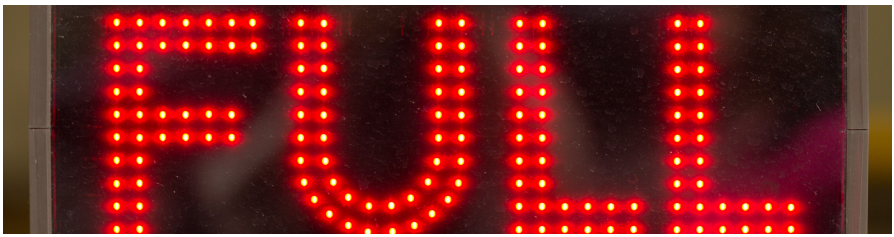
The afterburn effect isn't as notable as some people claim. Of course, your body continues to burn calories after physical activity, but that's only about 6% of the calories burned during exercise for low-intensity activity, or up to 15% for things like HIIT.

Hormones and Weight

Hormones play a role in almost every bodily function.

They help facilitate and regulate everything from sadness to hunger and thirst.

Some hormones tell our bodies we are hungry, while others indicate that we are fully satiated.



The hormones that induce the feeling of fullness are the following:

- Leptin: It's produced by our fat cells when they want to inform us that we've consumed enough fat to eat and should stop eating.

  People with leptin resistance struggle to lose weight. Having more body fat disrupts our leptin sensitivity. When we have leptin resistance, our body doesn't recognise the messages that leptin is trying to send us.

- Insulin: It's produced in the pancreas, and its primary purpose is to regulate blood sugar levels and encourage fat storage.

  People with diabetes might notice some weight gain as a side effect of insulin treatments.

- Cholecystokinin (CCK)- It's released by small intestine cells as a response to fat and protein. It stimulates the fullness centers in our brain.

- Obestatin- A hormone that opposes ghrelin, it is an appetite suppressant.

- Some others like pancreatic peptide YY, peptide nesfatin-1, hormone oxyntomodulin, and glucagon-like peptide-1.

The hormones that induce the feeling of hunger are the following:

- Ghrelin- It is a hormone that stimulates the hypothalamus in a way that makes us feel hungry. It's also involved in glucose metabolism and the sleep-wake cycle, among other things.

- Agouti-related protein- Produced in the brain, its production is stimulated by ghrelin.·

- Others, such as neuropeptide Y and motilin.

Other hormones that might influence weight gain and weight loss:

- Cortisol- The famous "stress" hormone. Its secretion is vital during the day, but chronically high cortisol levels can lead to health problems.

  It increases the appetite for fatty and sweet foods.

- Estrogen- The female sex hormone. It's also present in males but in much lower amounts.

  Low estrogen levels are linked to fat accumulation around the stomach, but high levels are commonly seen in obese people.

  Like with every other hormone, balance is crucial.

- Progesterone- It's vital for normal thyroid function. It decreases our organs' response to estrogen, reduces fluid retention, lowers insulin levels, and improves sleep quality, among other things.

HIIT vs Steady State Cardio

The old debate needs to be settled once and for all.

Long story short - they both lead to weight loss, and the most optimal option is to do both of them.

HIIT

According to the American College of Sports Medicine (ACSM), high-intensity intervals are performed at 80 to 95% of your maximum heart rate for five seconds to eight minutes.

The longer the interval, the lesser the intensity, and vice versa, obviously.

Pros:

- **Time Efficient**

  HIIT burns 25-30% more calories than other forms of exercise, meaning it's a highly time-efficient option for a cardio workout. However, you also won't be able to work out for a long time because of the high intensity.

- **Improves Insulin Sensitivity**

  Studies have found that HIIT reduces blood sugar and improves insulin resistance.

- **Sport Specific for A Lot of Sports**

  A lot of sports, for example, basketball and volleyball, are performed intermittently. This means they are comprised of short bouts of high intensity and effort, followed by incomplete rest periods.

- **Improved Heart Health**

  It reduces your resting heart rate and blood pressure. It increases the maximal stroke volume and cardiac output.

Cons:

- **More Stress on The Joints**

  HIIT usually consists of some forms of jumps or sprints, which are great, but not for someone with little working out experience and/or joint problems.

- **Not Beginner Friendly**

  Beginners should advance to at least the intermediate stage in their fitness journey before starting HIIT protocols.

- **Generally Harder Than Steady State Cardio**

  Because of the high-intensity nature of this type of training, it is usually much more uncomfortable than regular low-intensity and steady state cardio.

- **Easy To Overtrain**

  Once again, because of all of the joint stress and high intensity, along with the short duration of it, it's easy to go over your current capacity and injure yourself.

Steady State Cardio

This type of training has gotten a bad rep over the years in certain circles because people think it's somehow inferior to HIIT.

It is, but HIIT is also inferior to steady state cardio in certain aspects.

- Its main characteristic is maintaining a certain intensity, speed, and work rate throughout the session.

Pros:

- **Increased Endurance**

  Steady state cardio is fantastic for building endurance because the workouts last much longer than HIIT sessions. This is useful for laying down the foundation for any sport and general health.

- **Uses Fat for Fuel During the Workout**

  Since we have time to breathe enough oxygen during this type of training, we quickly move on from carbs to fat as our primary energy source.

- **Faster Recovery**

  Because of the lower intensity and less stress on the joints and the central nervous system, steady state cardio is much easier to recover from than HIIT.

- **Can Be More Joint Friendly**

  Although you may accumulate more ground contacts with running, for example, compared to jumping and sprinting, the impact is much easier on the joints.

- **Improved Heart Health**

  By keeping your heart rate in a moderate range for

extended periods (30 to 90 minutes), your heart chambers get filled with blood repeatedly. The walls of the left side of your heart stretch, and your left ventricular cavity gets larger. This is great because it leads to a lower resting heart rate and blood pressure and a more efficient heart.

Cons:

- **Can Become Boring**

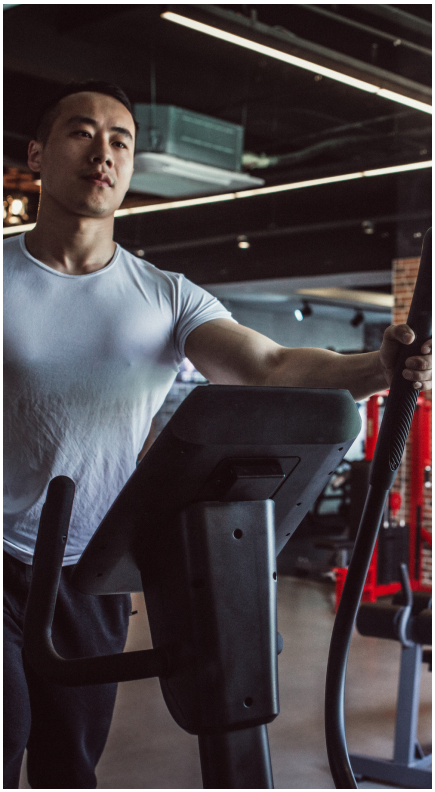
  Steady-state cardio takes a long time, and you may find it boring after a while. With HIIT, you're fighting to stay alive, so you don't have enough time to get bored.

- **Potential Overuse Injuries**

  Because of the repeated ground contacts and long durations, overuse injuries are pretty common with this type of training.

- **Time-Consuming**

  To get the full benefits, you need to train for extended periods of time.



As you can see from all of the pros and cons, both options are excellent in their respective rights.

If you're a beginner, start with steady state cardio and work up to HIIT.

If you're intermediate or advanced, combine both training modalities to your advantage to reap maximum benefits.

Calories In vs. Calories Out or Hormones?

Another common debate is whether or not fat loss is as simple as just eating fewer calories or are hormones to blame for you not being able to lose weight.

Neither is entirely wrong, but neither is completely correct too.

While Calories In vs. Calories Out (CICO) matter a lot, it doesn't explain the whole story behind the Energy Balance Equation (EBE.)

EBE, among other things, includes CICO, but it doesn't stop there:

The "Calorie In" part of EBE depends on:

- **Food Consumed**
  Influenced by culture, socioeconomic status, education, energy density, availability, etc.
- **Appetite**
  Influenced by hormones that we already talked about.
- **Absorbed Calories**
  Influenced by age, energy status, gut microbiome, food preparation, etc.
- Other factors, like **medication, psychological factors, medicalconditions, etc.**

The "Calorie Out" depends on:

- **Energy Burned At Rest**

  Influenced by age, gender, body composition, hormones, genetics, etc.

- **Energy Burned Through Exercise**

  ·Influenced by body composition, exercise duration, intensity, type, frequency, gender, etc.

- **Energy Burned By Metabolizing Food**

  Influenced by macronutrient properties of the food.

- **Energy Burned By Non-Exercise Activity**

  Influenced by body composition, genetics, leisure activities, occupation, energy status, stress levels, etc.

- **Other factors, like medication, medical conditions, etc.**

As you can see, the complete picture is much broader than the term Calories In vs. Calories Out makes people believe.

Weight loss is a multicomplex process that isn't easily deductible to a catchy phrase.

Time Restricted Eating/Intermittent Fasting

Although it isn't the miracle solution to all of your problems, unlike what influencers try to tell you, it definitely has some great health benefits.

Time-restricted eating, or intermittent fasting, is a form of an eating pattern in which you alternate between eating and fasting intervals.

You can still eat the amount of food you usually eat, but only during a specific window of time during the day. This time window is known as the "eating window."

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We'll list some of the benefits that are backed by sufficient research.

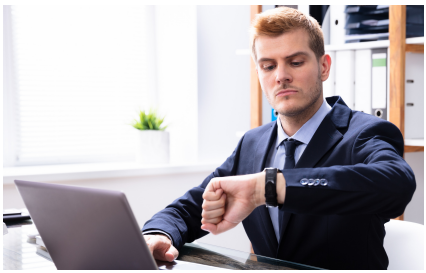
- Fasting reduces monocytes. Monocytes are cells that cause inflammation in your body.

- It can have positive effects on your hormonal status. Intermittent fasting can potentially reduce your blood sugar levels by 3-6% and insulin levels by as much as 32%. This will reduce your insulin resistance and put you at a lesser risk of developing type 2 diabetes.

- It also lowers your blood triglycerides, total cholesterol, and LDL cholesterol.

- Growth hormone can also be released during a fast. GH is one of the most important hormones with a wide array of functions, including muscle gain, fat loss, and improved mood.

- Since it's hard to consume the same amounts of calories on a time-restricted diet that you would usually eat, you will probably lose some fat as a result. In addition, the hormonal changes that happen during fasting can also help you lose weight.



A lot of fasting protocols exist.

Some have 16-hour fasting and 8 hours of eating periods, while others go to the extreme and only allow one meal per day, such as OMAD (One Meal A Day.)

Some people also do whole-day or multiple-day fasts.

it's not about how fast you **get** there,
it's about how long you **stay** there.