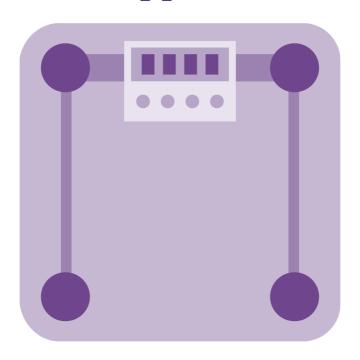
# **Examine**Fat Loss Supplement Guide



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## Introduction

As a graduate student, I pooh-poohed the posers who flaunted "sub-10% body fat" unconfirmed by DXA or at least hydrostatic weighing. How ignorant they were. I, being quantified, verified, was so much better than them. (No matter how balanced I seemed on the outside, inwardly I was a bit of a jerk.)

#### Q Digging deeper: DXA

*DXA scans* (aka DEXA scans) are one of the more accurate ways to estimate changes in <u>lean mass</u>, fat masshttps://examine.com/outcomes/body-fat/), and <u>bone density</u>. When you get a DXA scan, you lie down on a bed while a robotic arm moves up and down the length of your body, emitting very low-level X-rays and measuring how many get absorbed.

A DXA scan if fairly quick, usually taking 3–10 minutes, and it delivers measurements that are, on average, within 3 percentage points of those you'd obtain from the 4-component method — a more accurate but impractical, time-consuming, and expensive method restricted to scientific and medical studies. This means that if your body-fat percentage is 20% as measured by the 4-component method, a DXA scan should report a number between 17% and 23% (on average, remember; individual variations can reach 8 percentage points, which would give results between 12% and 28%).

Originally, DXA scans were employed to measure bone density, in order to detect (or track the development of) bone thinning or weakening (i.e., <u>osteoporosis</u>). Modern DXA machines can use equations to estimate body fat and lean mass. It means that modern DXA is a "3-component method": it gives readings for fat, lean soft tissue, and bone mineral. Note that what many studies report as "lean mass" from a DXA scan is more often "lean soft tissue" mass — i.e., the lean mass minus the bone mass.

As part of my quest for the lowest BF%, I took all the <u>fat loss</u> supplements. Nearly literally all of them. Having read a few studies selected by the supplements' manufacturers, I believed myself the repository of fat-loss secrets unknown to the crowd.

Then I took years of biostatistics and epidemiology, and I realized that <u>most of the studies I'd trusted</u> were of extremely poor quality. And years later, when I first worked with patients in an obesity clinic, I started to record on their intake forms the very same supplements I'd been taking. It makes sense ... who wouldn't want a quick fix if at all possible?

Everyone wants quick fixes, whether it's an obesity clinic patient trying to shed a hundred pounds or a gym rat trying to hit a BF% goal. Some gym rats who *don't* carry too much fat are easily convinced they do, and so suffer from poor body image and tarnished self-esteem. But they'll never admit it, even if they're secretly jealous of their friend's intricate arm veins.

These same insecurities plague those of us who don't aim for a freaky-low BF% but just want to be "toned". When we see bodybuilders or even health models on the covers of magazines, we can't help imagining them looking *shredded* year round, even when we *know* they can't be. And by the way, my fellow men, even if you do manage to bring your BF% down to the same level as a bodybuilder's on contest day, you still won't look as cut unless you <u>dehydrate</u> yourself until your skin is paper-thin (which, <u>need I mention it</u>, isn't healthy).

#### Caution: Female BF% vs. male BF%

The average female carries a lot more body fat than the average male, and the essential body fat of a female is also a lot higher (10% vs. 3%). A male with 5% body fat can be ripped. A female with 5% body fat is dead.

In short, women shouldn't compare their BF% to their male friends'. That said, it can be fun to compare the BF% of males with that of females for the same body-composition category, and you can do that by comparing <u>this graph</u> to <u>that one</u>.

So what does it all mean? Well, that you need to ask yourself the right questions, to begin with. Here, the first question isn't "How do I lose fat?" That isn't even the *second* question. The first question is "How much fat do I carry?" The second, "What's my fat goal?" And finally, the third, "How do I get there?" (Which usually translates as "How do I lose fat?")

# How much fat do I carry?

Scales, the normal kind, can't answer that question. They can tell you how much you *weigh*, but not how much of that weight is fat, how much is muscle, how much is water.

#### Q Digging Deeper: Mass vs. weight

*Mass:* A measure of how much matter is in an object. Unlike its weight, the mass of an object is constant. If an object's mass is 1 gram on Earth, its mass is 1 gram on the Moon.

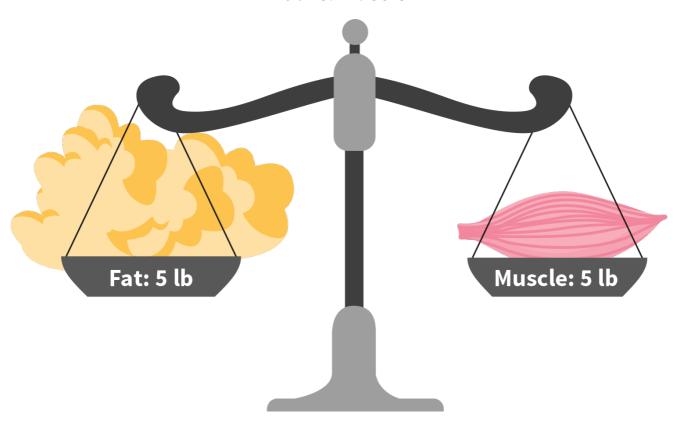
Weight: An object's relative mass. Unlike mass proper, weight is affected by gravity: it will be different on Earth and on the Moon; it can even vary on Earth (a given object is slightly heavier at sea level than at the top of a mountain, and at the equator than at the poles).

For our purpose, mass and weight are pretty much interchangeable: It just happens that "weight" is commonly appended to some nouns (e.g., body, water) and "mass" to others (e.g., fat, muscle). So we use "body weight" and "water weight" but "fat mass" and "muscle mass".

Scales can mislead you in several ways. People who start an exercise program in order to shed fat often despair when their scales show they're *gaining* weight; but don't forget that *weight* gain doesn't equal *fat* gain — when you exercise, you build muscle. Similarly, don't forget that *weight* loss doesn't equal *fat* loss: most of the weight lost during a short <u>detox diet</u> is water, not fat, and that weight is quickly regained.

Note that, if you lose as much fat mass as you gain muscle mass, you become leaner, since, for the same mass, fat is more voluminous than muscle.

#### Fat vs. muscle



Because they're so widespread, scales are commonly used to estimate one's "fitness level": you <u>calculate</u> <u>your BMI</u> by dividing your body weight in kilograms by your height in meters squared (kg/m²).

Overweightness starts at 25 and obesity at 30.

However, as the name implies (BMI stands for *Body Mass Index*), this "measure of body fat based on height and weight" looks at total body mass, not at body-fat mass. And because it was designed for sedentary people, it routinely classifies athletes — who, as a rule, carry more muscle than people who don't exercise — as "overweight".

**BMI Classification** 

CATEGORY	BMI*	BMI FOR ASIAN AND SOUTH ASIAN POPULATIONS
Severely underweight	<16.5	
Underweight	16.5–18.4	<18.5
Normal weight	18.5–24.9	18.5–22.9
Overweight	25-29.9	23-27.5
Obesity	≥30	>27.5
- Obesity class I	30-34.9	
- Obesity class II	30-34.9	
- Obesity class III	≥40	

<sup>\*</sup> kg/m<sup>2</sup>

Adapted from Weir and Jan. StatPearls. 2019.  $\ ^{[3]}$   $\$  WHO Expert Consultation. Lancet. 2004.  $\ ^{[4]}$ 

Don't throw away your measuring tape just yet, though. If you use it *more*, you can get a better idea of your body fat. For instance, where the BMI formula is based on just weight and height, the <u>US Navy formula</u> also

includes neck and abdomen/waist, plus hips for women.

And if you want to be *really* precise, you can take a dunk. <u>Hydrostatic weighing</u>, the old gold standard to determine body fat, has you weigh yourself normally then under water. This method is based on a simple fact: fat floats. Yet the method itself doesn't qualify as *simple* — it requires some heavy, expensive equipment, and so is mostly used for research.

Dual energy X-ray absorptiometry (DXA) is commonly used to measure bone density, as <u>we saw</u>, but it's also edging out hydrostatic weighing as the gold standard to determine body fat. Scans take just a few minutes, and while they used to be expensive and available only in medical facilities, now some health centers offer them for less than a hundred bucks.

#### Q Digging Deeper: Why do some people look more "ripped" than others?

As the popularity of DXA scans increases, one question keeps coming back: why do some people look more ripped than others (of the same sex), even when their BF% isn't lower?

There's more than one possible reason.

When we look at other people, we tend to focus on the upper body: we look at a man's forearms when he's wearing rolled-up sleeves, at his upper arms when he's wearing a T-shirt, at his abs when he's stalking the beach. The quads and glutes are much bigger muscles, yet we're much less likely to linger on them, especially when they're clothed. And since people can differ substantially as to where they carry their fat (On their lower or upper body? Under their skin or around their abdominal organs? ), they can also differ substantially in how ripped they look.

Another reason is water. The reason why bodybuilders have paper-thin skin when on stage isn't just their very low BF%; they're also dangerously <u>dehydrated</u>. Bodybuilders will take a diuretic and reduce their water intake in the days leading to a competition, as will many fitness models shortly before a photoshoot.

Finally, you can trick the eye. Darker skin makes you look more cut, which is why light-skinned bodybuilders will slather themselves with sunless tanning lotion.

They'll also shed and shave their body hair, which would otherwise obscure their muscle lines. And on the other side of the lens, a photographer can play with angles, lights, and shadows to accentuate a bulge or deepen an interstice.

And of course, there's Photoshop.

All right, but chances are that your neighborhood still doesn't have such a health center, and even if it does, a hundred bucks isn't pocket change to most of us — getting regular scans to assess your progress can become expensive. So what method can be used at home?

One option is a BIA device, which uses *bioelectrical impedance analysis* to estimate body water, and from there lean mass (aka fat-free mass), and from there body fat. To obtain numbers in pounds rather than in percentages requires the use of a scale, so most BIA devices also function as scales.

In fact, most BIA devices look exactly like scales, with the current traveling through your bare feet, whereas

in more expensive models the current travels through your feet and hands. But even the professional models you'll find in gyms aren't overly trustworthy.

Too many factors can affect the result, starting with your <u>hydration</u> level — the less water you carry, the more fat your BIA device will think you have. [8] If you own such a device, use it only in the morning, after going to the toilet but before eating or exercising, for the result will also be skewed if you are still digesting. Or have exercised within the past couple of hours. [10][11][12]

Another at-home option is body fat calipers. Calipers look like a pair of compasses and require that you (lightly) pinch your skin in several places; you can then use one of several formulae (the two most common being the Jackson and Pollock three-site and seven-site formulae[13][14]) to calculate your percentage of body fat, and from there your body fat in pounds (as long as you know your weight).

Don't put too much stock in your first result, though; it can be off, especially if you currently carry too much fat. The strength of calipers lies not so much in their providing an accurate number than in their accurately tracking changes in body composition.

In other words, as long as you pinch your skin at the same places in the same way, a caliper will tell you reliably if your percentage of body fat increases or decreases. (There are tricks you can use to pinch your skin at the same places each time; you can, for instance, refer to personal landmarks: belly button, moles, scars ...)

As it stands, a near ideal "combo" would be to start with a DXA scan, measure your body fat with a caliper or BIA on that same day, compare the numbers, and then use the caliper or BIA at regular intervals (such as once per week) to track your evolution.

#### Tip: How to accurately measure body-composition changes

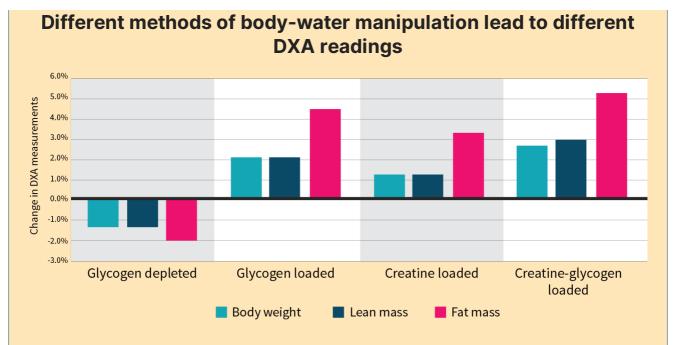
There are many factors that can affect your body-composition measures. Take the following into account to help ensure you are getting the most accurate readings possible.

Various diets can influence body composition measures. For example, in the first week or so on a ketogenic diet, you will drop water weight and use up much of your glycogen. Because these changes can throw off tools used to measure fat mass and lean mass (DXA, BIA, BOD POD®), it's best not to use pre-keto measurements as your baseline.

On the flip side, a high-carb diet could cause your glycogen stores to fill up and increase water weight. To help avoid erroneous measures caused by these shifts, wait 1–2 weeks for your body to adapt to your new diet. Then have measurements taken and use these as your baseline against which to compare future measurements.

This advice still applies if, instead of the tools listed above, you use calipers or calculations from limb measurements. It also applies if you decide to switch from a low-carb diet to a higher carb diet (or vice versa): eat your higher-carb diet for 2 weeks, then take new baseline measurements.

Another confounding factor you need to be aware of: creatine. Like glycogen, creatine causes water retention and thus can mess up with your measurements. So if you want to be able to compare two measurements, use creatine consistently or not at all.



Reference: Bone et al. Med Sci Sports Exerc. 2017. [16]

Creatine is just one example of a general rule: to reduce potential sources of error, try to *standardize* the conditions under which measurements are taken.

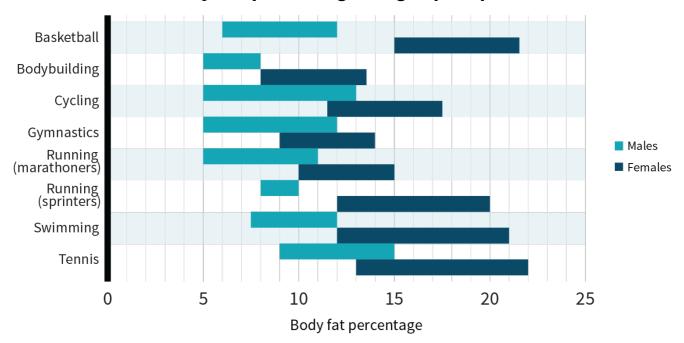
- Test at the same time of day (e.g., at 9 a.m.).
- Test under the same feeding conditions (e.g., before breakfast).
- Test under similar hydration statuses. Don't be over- or under-hydrated. Empty your bladder.
- Don't make any major dietary changes for 3 days before the test.
- Don't exercise for 24 hours before the test.
- Don't apply moisturizing lotions for 24 hours before the test.
- Wear the same or similar clothing (or none, if practicable).
- Use the same equipment, software/algorithm, technician, and body position.

# What's my fat goal?

The answer never starts with a number. Do you want to look great at the beach? Or just to avoid the health problems linked to an excess of body fat? Or are you an athlete? And if you are, does your sport have weight classes?

Even if it does, you must have noticed that fighters carry more fat than contest-day bodybuilders; even when weight class is a concern, there are still some performance advantages to keeping some fat on you, for very low body fat in athletes has been associated with physical and mental <u>fatigue</u>, chronic <u>pain</u>, and impaired <u>immunity</u>.

#### Body-fat percentage ranges per sport



Adapted from Kenney, Wilmore, and Costill. Body Composition and Nutrition for Sport (chapter 15 in *Physiology of Sport and Exercise, 5th ed.* Human Kinetics. 2011. ISBN:978-0736094092) ● Jeukendrup and Gleeson. Body Composition (chapter 13 in *Sport Nutrition, 2nd ed.* Human Kinetics. 2009. ISBN:978-0736079624)

As this graph shows, female athletes tend to carry more fat than their male counterparts. This is perfectly normal. Remember: you *need* some fat. You can't "burn" it all and keep on living. Your minimal percentage of body fat — the percentage below which your health is compromised — is called *essential fat*, and as <u>we saw</u>, it is not the same for men (3%) and women (10%).

For that reason, at the end of this intro, you'll find *two* graphs: <u>one for females</u>, <u>one for males</u>. Each will give you an idea of your "fat fitness" and of the range you should aim for to reach a certain goal.

Those graphs should remind you that your percentage of body fat matters more than your total body fat, and a lot more than your weight. When people say they want to lose *weight*, most often they should really say they want to lose *fat*.

Let's say you start at 150 lb with 20% body fat. At that point, you carry 30 lb of fat. Then, after training for half a year, you reach 153 lb (the horror!) with 17% body fat. At that point, you carry 26 lb of fat.

So you've gained 3 lb of weight, but you've lost 4 lb of fat, which means you've gained 7 lb of lean mass. And if you've taken care of weighing yourself at the same time of the day (before breakfast but after going to the toilet, usually), that lean mass is muscle.

As <u>we saw</u>, fat takes a lot more space than muscle, so you can weigh more yet be leaner. And ladies, don't worry that gaining muscle will make you look "masculine"; it doesn't work that way. Even if you lift weights (and really, most of you should), you won't develop the same musculature a male can — not without the same testosterone a male has.

In other words, gaining some muscle will make you look toned, not muscular.

#### Tip: Diet is key

Exercising can help you build muscle *and* lose fat, but if we only consider fat loss, eating better usually trumps exercising more.

- Compared to exercise changes (alone), diet changes (alone) have been shown to produce around three times the weight loss.<sup>[17]</sup>
- The calories burned by a 5'10" man weighing 154 pounds and <u>running</u> a 5k (3.1 miles) are offset by just 7 small <u>chocolate-chip cookies</u> (367 vs. 379 kcal).

## How do I lose fat?

Ah, finally we're getting there. The answer is as simple as calories in vs. calories out. Except, not really. There are many reasons why weight loss, or weight gain, can't be boiled down to a simple equation (there are 9 kcal in one gram of fat; there are 454 grams in one pound; so if I ingest 4,086 kcal more than I need, I gain one pound of fat).

Calories are units of energy. To measure the caloric content of any item, edible or not, you can burn it in a bomb calorimeter. Unlike a bomb calorimeter, however, your body can't extract energy from everything — it can't even extract energy from all carbs dietary fibers are carbs, but you can't digest them, though some of your gut bacteria can).

Not only that, but even when you *can* digest something and convert it into calories, the process requires that you "burn" calories. This so-called <u>thermic effect of food</u> is greater for protein than for fat or carbs, and it can be affected by your age, the timing of your meal, and various other factors.

#### Q Digging Deeper: Know your fat

There are three predominant types of fat in your body.

- White Adipose Tissue (WAT). This is the kind of fat your physician warns you about. It can be damaging to health, particularly when it over-accumulates around your midsection. Fat's role as an endocrine organ is increasingly being researched, as hormones like leptin and adiponectin play critical roles in metabolic health.[18]
- Brown Adipose Tissue (BAT). Considered a 'healthy' fat in the body, it is a very metabolically active and highly thermogenic tissue. Though it is found in significant quantities in infants, adults tend to have very small deposits. It is thought that stimulating brown fat growth in adults could help fight weight gain. There has been an association seen between those having more brown fat being less likely to develop metabolic dysfunction. [19]
- Beige Adipose Tissue. This kind of fat can be thought of as the child of white and brown fat. It is found within white fat but displays many of the beneficial qualities of brown fat. White fat contains stromal vascular cells that help to shift the structure and function of the white fat cell to that of a brown fat cell. The amount of brown and beige fat tissue one has been inversely associated with body-mass index.[20]

Some supplements discussed in this guide can also affect the *calories in-out* equation through <u>thermogenesis</u>, lipolysis, and better nutrient partitioning (more nutrients sent to the muscles, less stored as fat).

Still, "calories in vs. calories out" *is* the simple answer to a complicated question, and for all the caveats it implicitly carries, it has practical applications. Start by assessing the amount of calories you need just to maintain your weight, based on your level of activity, then compare this number to the amount of calories you consume daily. That should give you a very rough idea of where you stand.

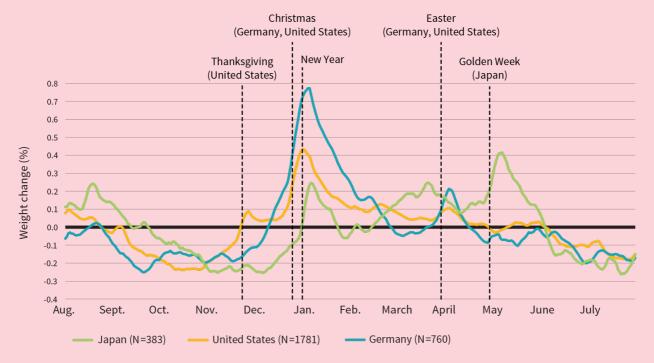
Then, as the weeks and months go by, record how much you consume (of each macronutrient) and how much weight, body fat, and lean mass you gain or lose. In this way you'll draw a much clearer picture of your actual caloric needs.

To lose fat, you'll need to end up in a caloric deficit on most days. You'll also need to keep yourself in check on "cheat days", since unrestrained binging can easily torpedo a diet through sheer caloric load and the reinforcement of bad habits. Supplements can help, but you'll have to help yourself too, either by eating less or by exercising more. Or both.

#### Laution: Don't let binging become a habit

You can partially compensate for <u>the occasional binge</u> by eating less the next day or exercising more, put you should be wary of letting binges turn into habits. Binges are often triggered by specific events — a stressful situation, maybe, or hunger-inducing TV ads, or the tantalizing scent of tasty food. If you let yourself react by binging, then the next time you encounter the trigger, you'll be more likely to binge again.

### Yearly weight change in Germany, Japan, and the U.S.



Adapted from Helander et al. N Engl J Med. 2016. [22]

Binge habits aren't easy to break, especially when you've long had them, so you might want to start by weakening them. Rather than reacting to a binge trigger by eating a plain salad or a big plate of nothing, you could try indulging *less* than the previous time (and start with a <u>satiating helping of protein<sup>[23]</sup>)</u>. Or you could reward yourself in another way — a way not related to food. Regular small improvements can add up over time.

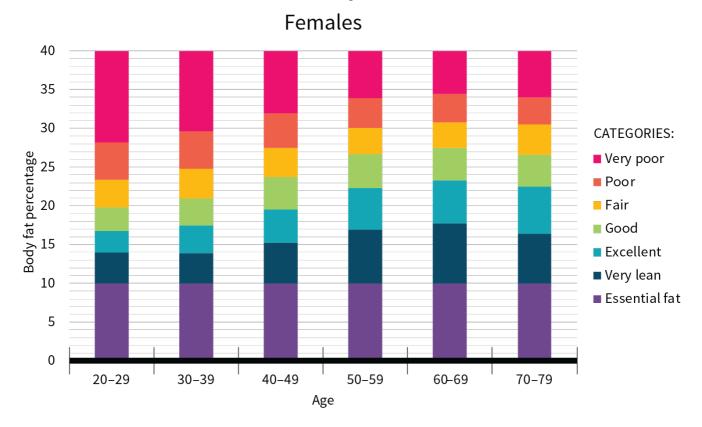
Don't overdo it, though. Drastic diets aren't just hard to maintain, they can also deprive you of some of the nutrients you need to stay healthy, and they make it hard to exercise. Correspondingly, don't go crazy with exercise — even if you don't overcompensate with excess food. Regular exercise helps maintain your basal metabolism, but going overboard can easily lead to injury, especially while on a diet.

In this guide, you'll learn about supplements that can help you lose weight, with or without exercise. Just as important, you'll learn to optimize your protein intake in order to lose more fat and less muscle.

Kamal Patel, Co-founder and Director

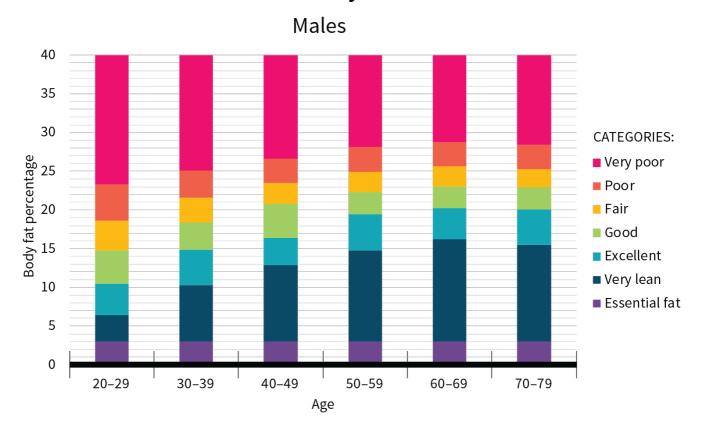
MPH, MBA, PhD(c) in Nutrition

# Female body-composition categories based on age and percentage of body fat



Adapted from American College of Sports Medicine. Body Composition (chapter 5 in ACSM's Health-Related Physical Fitness Assessment Manual, 4th ed. Lippincott Williams & Wilkins. 2013. ISBN:978-1451115680)

# Male body-composition categories based on age and percentage of body fat



Adapted from American College of Sports Medicine. Body Composition (chapter 5 in ACSM's Health-Related Physical Fitness Assessment Manual, 4th ed. Lippincott Williams & Wilkins. 2013. ISBN:978-1451115680)

## **Combos**

## **Core Combo**

Consume protein throughout the day (1.2–2.7 grams per kilogram of body weight, so 0.54–1.23 g/lb), with the help of a protein powder if necessary. Consult the <u>protein</u> entry to set the intake level best suited to your needs.

#### Tip: Try one combo alone for a few weeks

Taking too many supplements at once may prevent you from determining which ones are truly working. Start with just one of the combos suggested here for a couple of weeks before you consider making any modification, such as adding another supplement, altering a supplements dosage, or incorporating the supplements from an additional combo.

When adding another supplement to your regimen, be methodical. For example, you may wish to take all the supplements from two combos. Select the combo that you wish to try first and take this for a couple of weeks. Then, add one supplement from the second combo and wait another week to see how it affects you. Continue this process until you've added all the supplements you wish to.

If a supplement appears in two combos you wish to combine, don't stack the doses; instead, combine the ranges. For instance, if the range is 2–4 mg in one combo and 3–6 mg in the other, your new range becomes 2–6 mg. Always start with the lower end of the range — especially in this case, since the reason why one of the ranges has a lower ceiling in one combo may be due to a synergy with another supplement in the same combo. Reading through the full supplement entry may help you decide which dose to aim for, but if you're not sure, lower is usually safer.

# **Specialized Combos**

Combining supplements should always be done cautiously, but people combining stimulants should be especially careful. Stimulants can be synergistic; when combined, even low doses can have powerful effects ... and be potentially dangerous, notably for the heart.

## To burn fat without stimulants

Take <u>5-HTP</u> (300 mg/day, increasing to 500 mg/day over a week), <u>EGCG</u> (400–500 mg/day), (consult the dedicated entry to set your intake), and <u>#MCTs|MCTs</u> (2–12 g/day).

Once in a while, suspend supplementation of 5-HTP to assess if it is still able to reduce your carbohydrate cravings.

This specialized combo can be supplemented year round, on its own or in conjunction with the "stimulant" combo.

## To burn fat with stimulants

Take the following doses twice a day for 12 weeks, followed by a 12-week break.

Take 100–200 mg of <u>caffeine</u>. Once tolerance sets in, add <u>synephrine</u> (10–20 mg) and a <u>white willow bark</u> extract (60 mg of salicin). For both caffeine and synephrine, start at the lower end of the range.

If, for your next 12-week cycle, you wish for greater stimulation, add <u>yohimbine</u> (2.5 mg, increasing to 5 mg after a week and 7.5 mg after another week). Once accustomed to this protocol, you can add <u>forskolin</u> (25 mg).

# Other options

Adding <u>theanine</u> to an equal dose of <u>caffeine</u> can ward off overstimulation while retaining the benefits to attention span and focus. If you take 100–200 mg of caffeine twice a day, take 100–200 mg of theanine twice a day. Alternatively, you could drink several cups of black <u>tea</u> (the type of tea with the highest amount of caffeine).

Caffeine can be consumed as pills but also through coffee, tea, energy drinks, etc. You could try replacing 200 mg of caffeine by either 50–75 mg of guarana (assuming a 9% caffeine content) or 1 g of yerba mate leaf powder (about 17.5 mg of caffeine), but neither option is recommended, and both should be avoided if you take amphetamines (e.g., Adderall).

<u>Synephrine</u> (10–20 mg) can be replaced by a bitter orange extract (167–333 mg, assuming a 6% synephrine content), with the understanding that some of the flavonoids in bitter orange may interact negatively with pharmaceuticals.

<u>Salicin</u> (60 mg) can be replaced by a baby aspirin (81 mg). The warnings in the <u>white willow bark</u> entry also apply to aspirin.

# **Primary Supplements**

## **Protein**

## What makes protein a core supplement

Protein can support fat loss in different ways.

*First*, protein is more filling than carbohydrate or fat, though less so than protein *with* carbohydrate and/or fat.

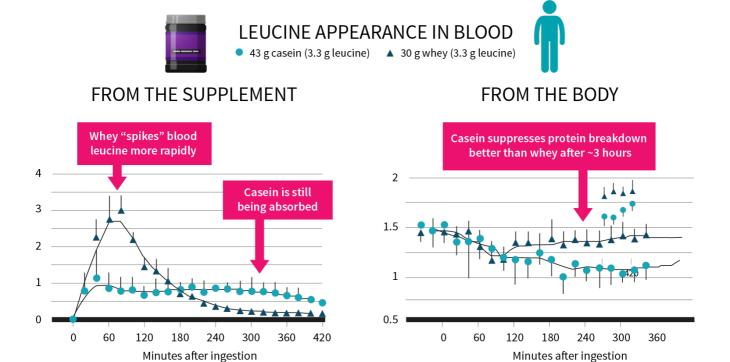
Second, digesting protein burns more calories than digesting carbohydrates or fat.

*Third*, converting protein into fat is inefficient; excess dietary protein (i.e., dietary protein not needed to support physiological functions, such as preserving lean tissues) is more likely to be oxidized for energy or converted into glucose to be stored as <u>glycogen</u>. On a low-calorie diet, consuming enough protein helps preserve <u>muscle mass</u>, which is important since the goal is not to lose *weight* but *fat*.

Any protein found in food or supplements is called dietary protein. Overall, <u>whole foods</u> are the healthier choice, but if your food intake does not cover your daily protein needs, you could add a supplement (preferably a powder, since the protein-to-calorie ratio of powders tends to be higher than that of other protein supplements, such as protein bars).

Whey protein and casein powders are both derived from milk protein (which is 20% whey and 80% casein). If you are neither lactose-intolerant nor vegan, look for a whey protein concentrate that is at least 80% protein. Whey protein is cheap and very anabolic (good for building muscle). Micellar casein is more expensive but more anti-catabolic (good for preserving muscle). Since micellar casein digests slowly, it is often seen as the ideal protein to consume before sleep, though some evidence suggests that bedtime protein may not provide any additional benefit if enough protein is consumed during the day. [25]

#### Kinetics of whey (fast) vs casein (slow) digestion



Whey protein concentrates are the most common type of protein powder; they're inexpensive and mix easily, and so are probably your best option if you are not vegan. Look at the food label: your powder should be close to 80% protein. A little lower is fine if the powder is flavored (any flavoring will use a percentage of the powder), but any big discrepancy should steer you away.

But what if you *are* vegan? Fortunately, you can still supplement with protein powders. For vegans, two popular options are <u>soy protein</u>, which is a complete protein, and a 70:30 pea:rice protein blend, whose amino acid profile is similar to that of whey protein.

## How to take protein

In the United States, the <u>Recommended Dietary Allowance</u> (RDA) of 0.8 grams per kilogram of body weight (0.36 g/lb) is considered the minimum amount of protein a healthy adult must consume daily to prevent muscle wasting when total caloric intake is sufficient. [26]

The current evidence suggests, however, that this amount has been underestimated. Recent studies point to 1.0–1.2 g/kg as the minimum daily intake for sedentary adults wishing to maintain muscle mass without losing or gaining weight, whereas adults with fat loss goals can benefit from 1.5–2.7 g/kg (0.68–1.23 g/lb). Even a reanalysis of the data used to establish the above RDA suggests the minimum daily intake should be at least 1.0 g/kg. [30]

#### Tip: Use our Protein Intake Calculator

Your protein needs hinge on many factors — notably your weight, health goals, and level of physical activity. Based on our research and the data you input, we can calculate your optimal daily protein intake. Click on the image below to get started!

# YOUR OPTIMAL PROTEIN INTAKE:

???

So, how much protein do *you* need daily? Here's a quick rundown of how much protein you may need in different situations. If you want to know more, check out our <u>in-depth article on protein needs</u>.

- If you're of *healthy weight, active, and wish to lose fat*, aim for 1.8–2.7 g/kg (0.82–1.23 g/lb), skewing toward the higher end of this range as you become leaner or if you increase your caloric deficit (by eating less or exercising more).
- If you're *overweight or obese*, aim for 1.2–1.5 g/kg (0.54–0.68 g/lb). This range, like all the others in this list, is based on your *total* body weight (most studies on people who are overweight or obese report their findings based on total body weight, but you'll find some calculators that determine your optimal protein intake based on your lean mass or your *ideal* body weight).
- If you're *vegan or obtain most of your protein from plants*, then your protein requirements may be higher because plant-based proteins are usually inferior to animal-based proteins with regard to both <u>bioavailability and amino acid profile</u>.

#### Daily protein intake

BODY WEIGHT	BODY WEIGHT	0.45	0.54	0.68	0.82	0.91	1.00	1.23	g/lb
LBS	KGS	1.0	1.2	1.5	1.8	2.0	2.2	2.7	g/kg
100	45	45	54	68	81	91	100	122	g
125	57	57	68	85	103	113	125	154	g
150	68	68	82	102	122	136	150	184	g
175	79	79	95	119	142	159	175	213	g
200	91	91	109	136	164	181	200	246	g
225	102	102	122	153	184	204	225	275	g
250	113	113	136	170	203	227	250	305	g
275	125	125	150	187	225	249	275	338	g

References: Schoenfeld and Aragon. J Int Soc Sports Nutr. 2018. [31] ● Jäger et al. J Int Soc Sports Nutr. 2017. [32] ● Thomas et al. Med Sci Sports Exerc. 2016. [33] ● Institute of Medicine. Protein and Amino Acids (chapter 10 in Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. The National Academies Press. 2005. DOI:10.17226/10490)

Unless you have a <u>pre-existing condition</u> that affects your liver or kidneys, the intakes in the above table will not harm these organs.<sup>[34]</sup>

Consume 20–40 g of protein within the two hours preceding or following your workout to help stimulate muscle growth. Spread the rest of your intake over a few meals, starting with breakfast, so as to provide your body with a consistent flow of amino acids.

#### Tip: Why don't you recommend brands or specific products?

#### For two reasons:

- We don't test physical products. What our researchers do all day, every day is analyze peer-reviewed studies on supplements and nutrition.
- We go to great lengths to protect our integrity. As you've probably noticed, we don't sell
  supplements, or even show ads from supplement companies, even though either option
  would generate a lot more money than our Supplement Guides ever will and for a lot less
  work, too.

If we recommended any brands or specific products, our integrity would be called into question, so ... we can't do it. That being said, in the interest of keeping you safe, we drew <u>a short list of steps</u> <u>you should take</u> if a product has caught your interest.

# **Secondary Supplements**

## 5-HTP

## What makes 5-HTP a primary option

5-Hydroxytryptophan (5-HTP) is an intermediate in <u>serotonin</u> production. Supplementing 5-HTP improves serotonin signaling, which may reduce carbohydrate cravings. Fewer and less intense carbohydrate cravings usually translate as reduced overall food intake, and thus as weight loss. Evidence suggests that 5-HTP works for people with <u>obesity</u> and/or <u>diabetes</u>; further research is needed to confirm whether healthier people can benefit.

Readily available as capsules and tablets, supplemental 5-HTP is extracted from the seed of the African shrub *Griffonia simplicifolia*.

5-HTP should not be taken alongside <u>antidepressants</u>, <u>antipsychotics</u>, or other medications that affect serotonin, such as <u>dextromethorphan</u> and <u>tramadol</u>.

#### **Production of 5-HTP**

#### **TRYPTOPHAN**

- Is an essential amino acid
- Is required for normal growth in infants
- Aids in nitrogen balance in adults

#### 5-HTP

- Can improve symptoms of fibromyalgia
- Aids in treating depression
- Helps reduce carbohydrate cravings

### SEROTONIN

- Is a neurotransmitter
- Helps regulate mood, appetite, and sleep
- Is associated with depression and other mood disorders when imbalanced

## How to take 5-HTP

Take either 300–500 mg once a day or 150–250 mg twice a day, preferably 30 minutes before a meal, especially one containing carbohydrates. If taken in the evening, 5-HTP may reduce food cravings before bed and may also improve <u>sleep quality</u> by helping the body produce <u>melatonin</u>, a hormone that regulates sleep.

Once in a while, you should suspend 5-HTP supplementation to assess if it is still able to reduce your carbohydrate cravings.

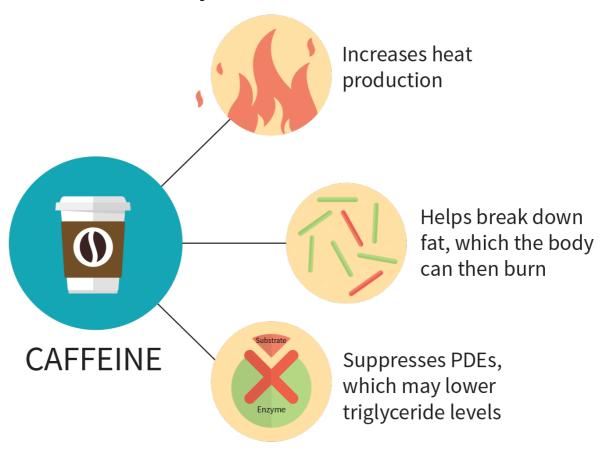
## Caffeine

## What makes caffeine a primary option

By causing epinephrine (aka <u>adrenaline</u>) and <u>dopamine</u> to be released, caffeine has beneficial effects on <u>energy</u>, <u>mood</u>, and <u>fat loss</u>. However, after prolonged consumption, only the ability to ward off <u>sleep</u> remains strong. Euphoria and excitability both fade away, while the fat loss effect is at least significantly diminished.

Two distinct effects contribute to caffeine's fat-burning properties: a thermogenic effect (in the short term, caffeine increases heat production) and a weaker lipolytic effect (in the long term, caffeine causes <a href="triglycerides">triglycerides</a> to release <a href="fatty acids">fatty acids</a>, which the body can then use for fuel).

### Three ways caffeine can assist in fat loss



More precisely, by inhibiting a category of enzymes called phosphodiesterases (PDEs), caffeine can increase the body's levels of cyclic adenosine monophosphate (<u>cAMP</u>). Elevated cAMP levels are associated with lower triglyceride levels in fat cells (due to cAMP increasing lipolysis) and improved <u>protein synthesis</u> in muscle cells. Moreover, when PDEs are inhibited, compounds that increase cAMP levels (such as <u>synephrine</u> and <u>forskolin</u>) might become even more effective at increasing heat production.

Even though <u>coffee</u> is a popular beverage worldwide, caffeine is not innocuous. Regular consumption leads to <u>tolerance and often to dependence and withdrawal</u>. Caffeine interacts dangerously with several pharmaceuticals, notably <u>tizanidine</u> and a type of antidepressant called *monoamine oxidase inhibitors* (MAOIs)<sup>[25]</sup>.

Caffeine may also decrease blood lithium levels. Suddenly eliminating all caffeine from your diet can cause your lithium levels to rise. If you are on <u>lithium medication</u>, keep your day-to-day caffeine intake roughly the same. If you wish to stop taking caffeine, talk with your physician about slowly weaning yourself from it.

Caffeine can also interfere with glucose metabolism, raise <u>blood pressure</u>, raise <u>heart rate</u>, and increase urination (and so the risk of <u>dehydration</u> during exercise, though the effect is usually mild), but those four effects fade away as your tolerance to caffeine develops.

You might already be consuming more caffeine than you think. When you calculate your daily intake, consider all your <u>beverages</u>, foods, and supplements. Bear in mind that caffeine can be "hidden" in a product — for instance, if you read "guarana seeds" on a label, remember that those are richer in caffeine than coffee seeds.

## How to take caffeine

For healthy adults, caffeine intake up to 400 mg/day doesn't raise any general health concerns. While you *can* consume more, 400 mg is how much caffeine most healthy people can regularly consume in a day without suffering lasting harm.

#### Caffeine upper limit (400 mg) in number of drinks



References: McCusker et al. J Anal Toxicol. 2006. ☐ Desbrow et al. Nutr Health. 2019. ☐ Ludwig et al. Food Funct. 2014. ☐ Ludwig et al. Food Funct. 2014. ☐ Desbrow et al. J Agric Food Chem. 2013. ☐ McCusker et al. J Anal Toxicol. 2003. ☐ Angeloni et al. Food Res Int. 2019. ☐ Angeloni et al. Food Res Int. 2019. ☐ Desbrow et al. J Anal Toxicol. 2003. ☐ Angeloni et al. Food Res Int. 2019. ☐ Desbrow et al. J Anal Toxicol. 2003. ☐ Desbrow et al. Food Res Int. 2019. ☐ Desbrow et al. J Anal Toxicol. 2003. ☐ Desbrow et al. Food Res Int. 2019. ☐ Desbrow et al. J Anal Toxicol. 2003. ☐ Desbrow et al. J Anal Toxicol. ☐ Desbrow et al. J Anal Toxicol. ☐ Desbrow et al. J Anal Toxicol. ☐

To supplement caffeine for a prolonged period of time, take 100–200 mg twice a day (i.e., 200–400 mg/day). Caffeine in this range can be consumed through coffee or <u>tea</u>; do not supplement caffeine if you get enough through dietary sources. People unused to caffeine should start at the low end of this range. People who are sensitive or new to stimulants should supplement caffeine by itself before introducing other stimulants (such as synephrine).

Supplementing caffeine on an empty stomach can increase the rate of absorption, but it can also cause gastrointestinal upset. Caffeine can disrupt sleep when consumed in the evening, or even in the afternoon;

even if it does not prevent you from falling asleep, caffeine will impair the *quality* of your sleep. In healthy adults, the average half-life of caffeine falls between 5 and 6 hours, but this number can vary greatly between individuals, because of genetics and other factors — heavy smoking can double the rate of caffeine metabolism, pregnancy can halve it, etc.

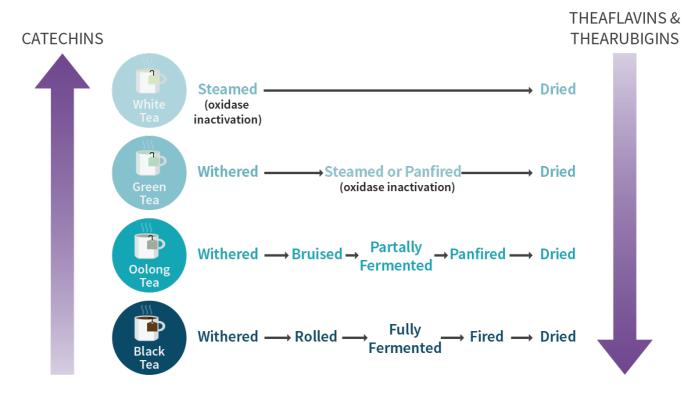
## **EGCG**

## What makes EGCG a primary option

Tea is the most popular beverage in the world after water. Although there are many kinds of herbal infusions, actual teas are made from the leaf of *Camellia sinensis*. From least to most fermented, the best-known types of tea are: green, yellow, oolong, black, and pu-erh. In most of the world, white tea undergoes little to no fermentation (a little more or a little less than green tea), but in China it is a fermented tea.

Catechins are phytochemicals with antioxidant properties. The less fermented the tea, the richer it is in catechins. Of the catechins found in tea, epigallocatechin gallate (EGCG) is the most bioactive and abundant (48–55% of total catechin content).

#### Processing tea impacts the type of polyphenols it contains



Reference: Higdon and Frei. Crit Rev Food Sci Nutr. 2003. [43]

As a fat burner, EGCG works by inhibiting catechol-O-methyltransferase (<u>COMT</u>), an enzyme that helps degrade catecholamines (the hormones and neurotransmitters <u>dopamine</u>, epinephrine, and <u>norepinephrine</u>). Catecholamines help break down stored body fat, which can then be used or excreted by the body. When EGCG inhibits COMT, it allows catecholamines to liberate stored fat over a longer period of time.

The addition of EGCG to a weight loss program has been shown to decrease body weight by 0.64–2.50 kg (1.41–5.51 lb) more than placebo over an average of 12 weeks.

### How to take EGCG

Take 400–500 mg of EGCG per day. The EGCG content of a standard cup of green tea can vary greatly, from less than 50 to more than 110 mg per cup. If you do not wish to take a supplement, you will need to drink some 4–8 cups a day to reach the minimum EGCG dose.

You can enhance the effects of EGCG by taking it with <u>caffeine</u>, but only if you are not a regular caffeine consumer. If you consistently take EGCG with caffeine, the fat-burning "boost" you get from pairing these supplements will diminish over time, and EGCG may become less effective than when taken on its own.

Taking EGCG on an empty stomach leads to a quadruple increase in blood concentrations but can cause <u>nausea</u>.

## **Yohimbine**

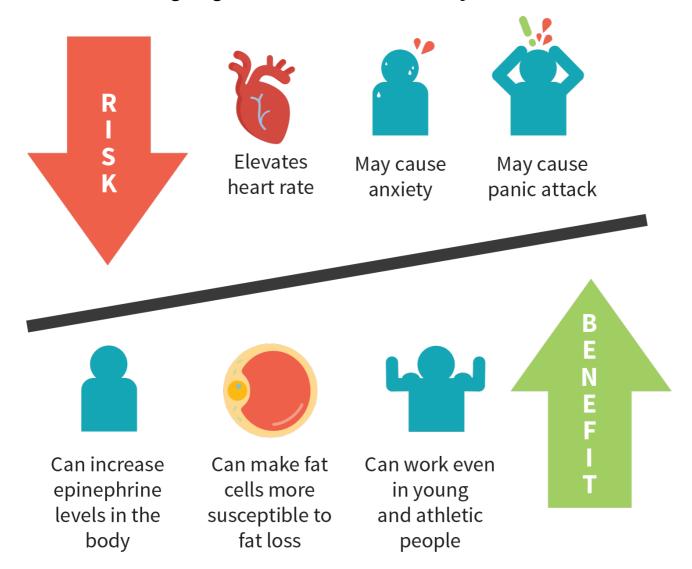
## What makes yohimbine a primary option

Yohimb*ine* is an alkaloid found in the bark of the African tree yohimb*e* (*Pausinystalia johimbe*). It works as a fat burner by increasing epinephrine (aka <u>adrenaline</u>) levels in the body and by inhibiting a regulatory process in fat cells that normally suppresses fat use. Unlike most other fat burners, yohimbine works even in young and athletic people.

Because the receptors it targets are found in higher levels around the oblique muscles, yohimbine might prove especially efficient at burning the "stubborn fat" of love handles. Studies that used topical yohimbine support this theory, but the evidence they provide is preliminary and weak.

Despite its efficacy, yohimbine is not a core supplement, due to a variety of adverse effects, such as elevated <u>heart rate</u> and <u>anxiety</u>. In fact, studies on anxiety commonly use yohimbine to *induce* anxiety. In people with panic disorders, it can even induce panic attacks. *Anyone susceptible to anxiety should steer clear of yohimbine*.

### Weighing the benefits and risks of yohimbine



Yohimbine should not be used alongside antipsychotics<sup>[44]</sup>. It should not be used alongside <u>antidepressants</u>, such as monoamine oxidase inhibitors (MAOIs)<sup>[35]</sup> or tricyclic antidepressants (TCAs). It should not be used by people who treat their migraines with ergotamines.

Yohimbine must be used carefully, especially when combined with other stimulants. People unaccustomed to stimulants should avoid yohimbine.

## How to take yohimbine

Yohimbine is dosed differently whether it is supplemented by itself or as part of a combo: 5–15 mg twice a day (i.e., 10–30 mg/day) is a typical dosage for yohimbine on its own, whereas 2.5–7.5 mg twice a day (i.e., 5–15 mg/day) is a typical dosage for yohimbine when combined with other stimulants. *It is strongly recommended to start at the low end of the range before supplementing higher doses.* Supplementation is more effective on an empty stomach (i.e., during short-term fasting or even just between meals).

Yohimb*ine* has fewer side effects than yohimb*e* (bark powder). For that reason, and because the yohimbine content of yohimbe can vary greatly, supplementing yohimbine is considered safer than supplementing yohimbe. However, companies selling "yohimbine" often use a bark extract whose yohimbine content has been estimated rather than ascertained, so the actual yohimbine content of a product can differ dangerously from the number on the label. Should you decide to supplement yohimbine, start with the lowest possible dose (often, 2.5 mg), then slowly work your way up.

Because <u>rauwolscine</u> is a compound similar to yohimbine in structure and function, it can be seen as an alternative, but it has only preliminary evidence for its effects.

# **Promising Supplements**

# Atypical Caffeine Sources (Guarana, Yerba Mate)

# What makes *atypical caffeine sources* a secondary option

Guarana (*Paullinia cupana*) and yerba mate (*Ilex paraguariensis*) are popular <u>caffeine</u> sources, but they require a lot more research before they can be recommended for fat loss. Both herbs contain unknown bioactive compounds, so avoid them if you take <u>amphetamines</u> (e.g., Adderall).

# How to take atypical caffeine sources

Different batches can contain different amounts of caffeine and other bioactive compounds, so always start with very low doses.

To supplement *guarana*, assuming a 9% caffeine content, take either 50 mg at both breakfast and lunch (i.e., 100 mg/day) or 50–75 mg once in the morning.

To supplement *yerba mate*, take 1 g of leaf powder in the morning. This dose provides about 17.5 mg of caffeine, but it should only be increased very cautiously.

Both herbs may be supplemented as <u>teas</u>, but this makes accurate dosing difficult. Too high of a dose can lead to excessive stimulation and cardiac complications, such as an irregular heartbeat (i.e., an <u>arrhythmia</u>).

## **Fiber**

## What makes fiber a secondary option

Dietary fiber is a kind of <u>carbohydrate</u> found in plant food. While your gut <u>microbiome</u> can feed on it, your body cannot absorb it. Therefore, while it helps make you feel full, fiber cannot be used as energy or stored as <u>body fat</u>; it is fermented in the colon then excreted. This is true of both soluble and insoluble fibers.

Soluble fiber dissolves in your stomach into a gel that slows down the passage of food from the stomach to the small intestine. This gel also helps lower blood sugar by delaying and reducing <u>carbohydrate</u> <u>absorption</u> in the body. Soluble fibers may also increase <u>insulin sensitivity</u>, possibly due in part to the short-chain fatty acids born from their fermentation by the gut microbiome.

Insoluble fiber does not dissolve in your stomach but gently "scrubs" your digestive tract. It speeds up the

rate at which food moves through your intestinal tract, yet it may also increase insulin sensitivity and bind to potentially harmful chemicals, such as <u>carcinogens</u>, allowing them to be excreted. [45][46][47]

Fiber has been theorized to enhance weight loss by decreasing <u>appetite</u> through hormonal signaling, and in the case of soluble fibers, delaying digestion. However, although many types of fiber have been investigated, only a small minority of studies have reported a worthwhile effect on weight loss, which is why fiber is only a secondary option.

Among the fibers investigated were different types of *inulin-type fructans* (ITFs). Of the only three studies on ITFs that noted an effect on weight loss, one used <u>yacón syrup</u> and the two others Synergy1, a proprietary enriched form of inulin. Aside from yacón, natural sources of ITFs include asparagus, bananas, chicory roots, dahlia tubers, <u>garlic</u>, Jerusalem artichokes, leeks, onions, and wheat, among others, but their effects of weight loss have yet to be explored.

A common ingredient in protein bars — isomalto oligosaccharide (IMO) — was once thought to be fiber, because it isn't broken down early in the digestion process. But it was later found that IMO gets mostly absorbed in the small intestine, providing 2.7–3.3 calories per gram (compared with 4 kcal/g for fully digestible carbohydrates). [48][49][50]

Dietary requirements for fiber have been established as <u>Adequate Intake</u> (AI) levels.<sup>[26]</sup> The AI for fiber can be thought of as the minimum level needed to ensure nutritional adequacy. While the recommended intake for adults ranges from 21 to 38 g/day, the US average intake is just 16 g, which falls 23.8–57.9% below the AI.<sup>[51]</sup>

#### Adequate Intake (AI) for total fiber (g)

AGE	MALE	FEMALE	PREGNANT	LACTATING
0-6 months	_	_	_	_
7–12 months	_	_	_	_
1–3 years	19	19	_	_
4-8 years	25	25	_	_
9–13 years	31	26	_	_
14-18 years	38	26	28	29
19-30 years	38	25	28	29
31–50 years	38	25	28	29
51–70 years	30	21	_	_
>70 years	30	21	_	_

Reference: Institute of Medicine. <u>Dietary, Functional, and Total Fiber</u> (chapter 7 in *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids.* The National Academies Press. 2005. DOI:10.17226/10490)

## How to take fiber

First, try to <u>eat your fiber</u> via whole foods, as isolated fiber supplements do not fully replicate the health benefits obtained from fibrous foods.

#### What 25 grams of fiber a day looks like



Two slices of whole wheat bread (6g)



Cup of oatmeal (4g)



Half cup of blueberries (2g)



Two cups of spinach (4g)



Apple (5g)



Cup of brown rice (4g)

\*Values are approximate and can vary

<u>Psyllium</u>, glucomannan, beta-glucan, and ITFs are soluble fibers. <u>Chia seeds</u> and oat brans contain both soluble and insoluble fibers.

To supplement <u>psyllium</u> or *glucomannan*, take 5 g half an hour before a meal, two or three times a day (i.e., 10–15 g/day).

To supplement beta-glucan daily, take 1.5-6 g of a pure powder or 20-80 g of oat bran.

To supplement *ITFs* daily, take either *Synergy1* (30 g) or *yacón syrup* (140 mg per kilogram of body weight, so 63.5 mg/lb). A higher dose of yacón syrup (290 mg/kg/day, so 132.5 mg/lb/day) led to gastrointestinal symptoms in some of the study participants.

To supplement <u>chia seeds</u> daily, take up to 50 g. Chia seeds can absorb 27 times their weight in water, leading to a greater feeling of satiety (if you have a history of swallowing problems, like <u>dysphagia</u>, let the chia seeds expand in liquid *before* eating them). Alternatively, take up to 35 g of chia seed flour, which can be added to baked goods for ease of consumption.

You can mix those different options, but keep an eye on your total dosage. For instance, in one day you could take one third of the upper dosage for glucomannan (5 g), one third of the upper dosage for psyllium (5 g), and one third of the upper dosage for chia seeds (about 15 g).

Regardless of where your fiber comes from (foods, supplements, or both), take these three steps to minimize unwanted adverse effects.

- 1. Gradually increase your fiber intake over a period of 1–2 weeks. This will allow time for your microbiome to adjust and help you identify your tolerance threshold. If taking a fiber supplement, begin with 3–4 g a day for the first few days before increasing your dose.
- 2. Ensure you are taking in enough fluids as you increase your fiber intake. A fiber intake of 40-70

g/day can be generally well tolerated, with sufficient fluid intake, in healthy adults without intestinal issues (e.g., IBD, IBS, celiac, Crohn's, ulcerative colitis, low intestinal motility). Consume at least 240 mL (8 oz) of fluids when you take fiber. This amount is suitable for up to a 10 g fiber dose, although individual results will vary. If you are particularly sensitive, drink 296 mL (10 oz) of fluid for every 5 g fiber dose.

3. Split your fiber intake evenly across meals to ease digestion.

# Medium-chain Triglycerides (MCTs)

## What makes MCTs a secondary option

Fatty acids can be classified as short-chain, medium-chain, long-chain, and very-long-chain. Fatty acids with 6 to 12 carbon atoms (C6:0 to C12:0) are usually considered medium chain. Arguments exist in favor of reclassifying C12:0 as long chain, however, since it metabolizes differently from C6:0, C8:0, and C10:0, the fatty acids suspected to support fat loss.

Medium-chain triglycerides (MCTs) are formed when medium-chain fatty acids are bound together. Coconuts, often touted for their high MCT content, are rich in C12:0 (aka <u>lauric acid</u>) more than in C6:0, C8:0, and C10:0. <u>Coconut fat/oil</u> is about 44% lauric acid and 13% MTCs.

MCTs are thought to help with weight loss by increasing <u>thermogenesis</u>. Because MCTs are smaller and more water soluble than long-chain triglycerides (LCTs), they are rapidly metabolized ("burned") and so less likely to end up stored as fat. Actual weight loss results (in controlled trials) have been lackluster, though, which is why MCTs are only a secondary option.

It has also been hypothesized that MCTs could help preserve muscle during periods of caloric restriction, but study results thus far have proven equivocal.

### How to take MCTs

To supplement MCTs, take 2–12 g of C8:0 (i.e., <u>caprylic acid</u>) or C10:0 (i.e., <u>capric acid</u>) per day. Higher doses (20–54 g/day) have sometimes been used in clinical trials, but they failed to elicit any additional weight loss benefits. Moreover, while high doses of MCTs do not appear to negatively affect the lipid profiles of healthy individuals, they amount to quite a lot of calories (486 kcal for 54 g).

MCTs can be taken with or without food. The MCTs you add to your diet should replace some of the LCTs you usually consume. Among oils rich in LCTs are corn oil, safflower oil, and soybean oil.

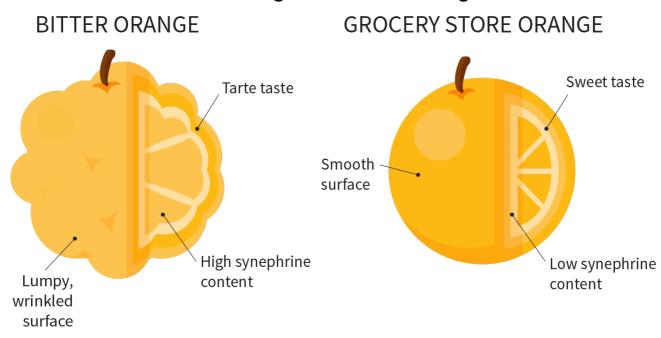
MCTs are generally well tolerated, but taking too much at once (based on individual tolerance levels) may result in <u>diarrhea</u>.

# **Synephrine**

## What makes synephrine a secondary option

Only one citrus fruit contains enough p-synephrine to affect us: *Citrus aurantium*, better known as bitter orange — not to be confused with the oranges you see at the grocery store. When used carefully, p-synephrine is safe and can reliably cause a mild increase in metabolic rate. Other variants, such as o-synephrine and m-synephrine, have less evidence for their efficacy and safety.

### Bitter oranges vs. normal oranges



Like <u>ephedrine</u>, synephrine affects the <u>dopamine</u>, epinephrine (aka <u>adrenaline</u>), and norepinephrine (aka noradrenaline) systems, causing an increase in <u>metabolic rate</u>. Like ephedrine, synephrine can be used indefinitely without losing its fat-burning effect, though the feeling of stimulation may fade over time. Like ephedrine, though to a lesser degree, synephrine is a vasoconstrictor (it constricts blood vessels) and thus can interact negatively with monoamine oxidase inhibitors (MAOIs)[35], a kind of <u>antidepressant</u>.

Synephrine has only been studied in overweight people — unlike <u>yohimbine</u>, which has also been studied in lean individuals. As a stimulant, synephrine is less potent than yohimbine and seldom taken on its own; it is most often used to complement <u>caffeine</u>, in combination with a white willow bark extract.

## How to take synephrine

Take 10–20 mg twice a day (i.e., 20–40 mg/day). Start at the lower end of the range, especially if you choose to supplement synephrine with other stimulants (or with supplements that potentiate stimulants, such as <u>EGCG</u>).

Synephrine should be supplemented on an empty stomach in the morning, and again 6 to 8 hours later. If supplementing synephrine on an empty stomach causes nausea, take it with a meal instead.

Synephrine can also be supplemented through a bitter orange extract, in which case said extract should be dosed in accordance with its synephrine content. For example, to supplement 10 mg of synephrine through a bitter orange extract with a 6% synephrine content, take 167 mg of the extract.

Bitter orange extracts also a class of plant chemicals known as flavonoids, which may further raise your *resting metabolic rate* (RMR). However, at least two of those flavonoids (naringenin and <u>hesperidin</u>) also

interact with several drug-metabolizing enzymes, which means that *bitter orange extracts may interact* negatively with pharmaceuticals and thus cannot be recommended over isolated synephrine.

## **Theanine**

# What makes theanine a secondary option

While theanine (the amino acid L-theanine) does not directly influence fat loss, it can be of use to people supplementing stimulants, notably <u>caffeine</u>. Its calming effect on the nervous system can reduce the overexcitability caused by stimulants without decreasing the stimulant-derived benefits to focus and <u>attention</u> span. In fact, the improvements in concentration induced by caffeine and theanine respectively have been shown to be synergistic.

Theanine can be added to any stimulant that provides too much nervous energy at the standard dose.

## How to take theanine

If you take *caffeine*, take an equal dose of *theanine*. At the lower end of the range, if you take 100 mg of caffeine twice a day, take 100 mg of theanine twice a day (i.e., 200 mg/day). At the higher end of the range, if you take 200 mg of caffeine twice a day, take 200 mg of theanine twice a day (i.e., 400 mg/day).

## White Willow Bark

# What makes white willow bark a secondary option

White willow bark is a plant source of <u>salicin</u>, which is metabolized into <u>salicylic acid</u>, a cousin of acetylsalicylic acid, better known as <u>aspirin</u>. Aspirin in excess is less harmful than salicylic acid in excess, but you need a lower dose of salicin than of aspirin, thanks to synergistic compounds in white willow bark. As it stands, extracts of white willow bark are overall safer than aspirin, which is more likely to damage the lining of the digestive tract. Nevertheless, patients with known aspirin allergy should avoid willow bark products.

By inhibiting prostaglandin production in neurons, salicin can enhance stimulatory signaling and the effects of epinephrine (aka <u>adrenaline</u>). Salicin is thought to be synergistic with the caffeine-synephrine combo because aspirin has been shown to be synergistic with the caffeine-<u>ephedrine</u> combo (aspirin can potentiate the increase in epinephrine and norepinephrine caused by ephedrine). In short, there is good reason to believe that salicin, and thus white willow bark, can enhance the fat-burning effect of the caffeine-synephrine combo (to a greater extent in people with a higher body fat percentage).

White willow bark is only a secondary option because it helps little with fat burning on its own and because it may interact with some drugs — notably <u>blood thinners</u> (anticoagulants), such as <u>warfarin</u> (Coumadin).

Although to a lesser extent than aspirin, salicin is itself a blood thinner, which is another reason why white willow bark works well with caffeine and synephrine: It can reduce the strain on the heart caused by these two vasoconstrictors.

## How to take white willow bark

Take 60 mg of *salicin* twice a day (i.e., 120 mg/day). A white willow bark extract should be dosed in accordance with its salicin content. For example, to supplement 60 mg of salicin through a white willow bark extract with a 15% salicin content, take 400 mg of the extract.

Salicin is most effective when taken with <u>synephrine</u> and <u>caffeine</u>, along with a meal to reduce the possibility of <u>heartburn</u> or upset stomach.

# **Unproven Supplements**

## **Berberine**

# What makes *berberine* an unproven supplement

Berberine is an alkaloid compound extracted from various plants, such as *Berberis aquifolium*, *Berberis aristata*, and *Argemone mexicana*. It can lower blood sugar levels by activating enzymes that draw blood glucose into cells and signaling that glucose should be used for energy production. [52]

Berberine helped with weight loss in a few studies, but they were of low quality. Among other problems, they often did not implement blinding, randomization, or control groups, and they mostly failed to differentiate between weight loss and fat loss. Higher-quality studies attributed no weight or fat loss to berberine.

Berberine interacts with several enzymes and thus has the potential to interact with many pharmaceuticals. Not all are known, but documented drug interactions include <u>losartan</u> (Cozaar), <u>dextromethorphan</u> (Vicks, Robitussin, Tussin Cough, Delsym), <u>midazolam</u> (Versed), and various oral contraceptives. <u>Do not take berberine if you are on cyclosporine</u> (Neoral, Sandimmune, Gengraf), as berberine may interfere with its metabolism.

Moreover, higher doses (>1 g/day) can cause gastrointestinal upset. For those reasons, and because it does not even seem to support fat loss, berberine is not recommended for inclusion in any fat-loss combo.

## Coleus Forskohlii

# What makes *Coleus forskohlii* an unproven supplement

Coleus forskohlii is an herb historically used in Ayurvedic medicine. It can increase the body's levels of cyclic adenosine monophosphate (<u>cAMP</u>), one of the molecules responsible for the effects of some stimulants. It might also improve the efficacy of other supplements that increase cAMP, such as <u>caffeine</u> and <u>synephrine</u>.

Elevated cAMP levels are associated with lower <u>triglyceride</u> levels in fat cells (due to cAMP increasing lipolysis) and increased <u>protein synthesis</u> in muscle cells, yet there's currently no solid evidence linking *Coleus forskohlii* to fat loss or muscle gain. Based on its theorized mechanism of action, if this herb helps at all, it is more likely to benefit overweight than lean people.

Because of those caveats, and the limited number of randomized controlled trials in humans, Coleus

#### **Green Coffee Extract**

### What makes *green coffee extract* an unproven supplement

Green coffee extract (GCE) is an extract of unroasted, green coffee beans, rich in <u>chlorogenic acid</u>. While chlorogenic acid may benefit <u>blood flow</u>, there is limited evidence that it reduces <u>blood sugar</u> levels and none that it helps with fat loss. There is no compelling reason to include it in any fat-burning combo.

#### Green coffee extract: a cautionary tale A study in *The Journal of* Dr. Oz begins touting Millions of dollars' The original study is Diabetes, Metabolic GCE as a "miracle worth of GCE sells in retracted. Trial data Syndrome, and Obesity weight loss pill" the following years could not be independently claims that the participants taking GCE verified for accuracy lost about 1.5 lb/month

Poorly conducted trials can lead to exceptional results. It is usually best to wait and see if those results can be replicated before drawing a conclusion.

#### **Fucoxanthin**

# What makes *fucoxanthin* an unproven supplement

One human study showed benefit from 2.4–8 mg/day, but it used a proprietary <u>seaweed</u> extract, has never been replicated, and its results seem too good to be true: an average fat loss of 3.6 kg (7.9 lb) in 16 weeks. More research is needed before fucoxanthin can be recommended for fat loss.

### Raspberry Ketone

# What makes *raspberry ketone* an unproven supplement

Raspberry ketone is a molecule initially extracted from raspberries but now mass-produced synthetically for use in perfumes and cosmetics.

Early evidence suggested that raspberry ketones could promote fat oxidation, but the ketone concentration required for this effect is too high to be achieved through oral supplementation. The original fat loss claim stems from toxicity studies in animals, not from fat loss studies in humans, and the one fat loss study in humans that showed benefit was highly confounded: the product tested contained not only raspberry ketones but also <u>caffeine</u>, <u>capsaicin</u>, <u>garlic</u>, <u>ginger</u>, and bitter orange as a source of <u>synephrine</u>, making it impossible to assess the respective efficacy of each ingredient.

In short, current evidence does not support the inclusion of raspberry ketones in any fat-loss combo.

### **Inadvisable Supplements**

### Hoodia Gordonii

## What makes *Hoodia gordonii* an unproven supplement

According to preliminary animal evidence, a bioactive compound in *Hoodia gordonii* (an African cactus) could suppress <u>appetite</u>, but follow-up research has confirmed that oral supplementation does not deliver this bioactive to the brain. Moreover, hoodia supplementation is associated with substantial <u>blood pressure</u> increases and minor but concerning increases in <u>heart rate</u> and <u>liver enzymes</u>.

There is no evidence that *Hoodia gordonii* can help with fat loss, but plenty that it can damage the liver and the cardiovascular system. *Hoodia gordonii* should not be included in any combo.

#### Senna Alexandrina

# What makes *Senna alexandrina* an unproven supplement

Senna alexandrina, or just senna, is an herb frequently marketed as a <u>dietary cleanser and detoxifier</u>. However, while it can cause temporary weight loss thanks to its potent laxative effect, it lacks an inherent fat loss effect.

Daily or chronic use of any potent laxative (except for <u>fiber</u> and <u>caffeine</u>) can result in colon damage. Senna alexandrina should not be included in any combo.

### **FAQ**

## Q. What about the supplements not covered in this guide?

Our guides are regularly updated, often with new supplements. We prioritize assessing (and reassessing) the most popular of them and those most likely to work. However, if there is a specific supplement you'd like to see covered in a future update, please let us know by <u>filling out this survey</u>.

## Q. Can I add a supplement not covered in this guide to my combo?

Supplement with your current combo for a few weeks before attempting any change. Talk to your physician and <u>research each potential addition</u>. Check for known negative interactions with other supplements and pharmaceuticals in your current combo, but also for synergies. If two supplements are synergistic or additive in their effects, you might want to use lower doses of each.

#### Q. Can I modify the recommended doses?

If a supplement has a recommended dose range, stay within that range. If a supplement has a precise recommended dose, stay within 10% of that dose. Taking more than recommended could be counterproductive or even dangerous. Taking less could render the supplement ineffective, yet starting with half the regular dose could be prudent — especially if you know you tend to react strongly to supplements or pharmaceuticals.

#### Q. At what time should I take my supplements?

The answer is provided in the "How to take" section of a supplement entry whenever the evidence permits. Too often, however, the evidence is either mixed or absent. Starting with half the regular dose can help minimize the harm a supplement may cause when taken during the day (e.g., <u>fatigue</u>) or in the evening (e.g., <u>insomnia</u>).

### Q. Should I take my supplements with or without food?

The answer is provided in the "How to take" section of a supplement entry whenever the evidence permits. Too often, however, the evidence is either mixed or absent. Besides, a supplement's digestion, absorption, and metabolism can be affected differently by different foods. Fat-soluble vitamins ( $\underline{A}$ ,  $\underline{D}$ ,  $\underline{E}$ ,  $\underline{K}$ ), for instance, are better absorbed with a small meal containing fat than with a large meal containing little to no fat.

#### Q. What are DRI, RDA, AI, and UL?

The <u>Dietary Reference Intakes</u> (DRIs) is a system of nutrition recommendations designed by the Institute of Medicine (a US institution now known as the <u>Health and Medicine Division</u>). RDA, AI, and UL are part of this system.

- Contrary to what the name suggests, a Recommended Dietary Allowance (RDA) doesn't represent
  an ideal amount; it represents the minimum you need in order to avoid deficiency-related health
  issues. More precisely, it represents an amount just large enough to meet the minimum requirements
  of 97.5% of healthy males and females over all ages which implies that the RDA is too low for
  2.5% of healthy people.
- The Adequate Intake (AI) is like the RDA, except that the number is more uncertain.
- The *Tolerable Upper Intake Level* (UL) is the maximum safe amount. More precisely, it is the maximum daily amount deemed to be safe for 97.5% of healthy males and females over all ages which implies that the UL is too high for 2.5% of healthy people.

As a general rule, a healthy diet should include at least the RDA of each nutrient — but less than this nutrient's UL. This rule has many exceptions, though. For instance, people who sweat more need more salt (i.e., sodium), whereas people who take <u>metformin</u> (a diabetes medicine) need more <u>vitamin B12</u>.

Moreover, the DRIs are based on the median weight of <u>adults</u> and <u>children</u> in the United States. Everything else being equal (notably age, sex, and percentage of body fat), you likely need a lesser amount of nutrients if you weigh less, and vice versa if you weigh more. The numbers, however, are not proportional — if only because the brains of two people of very different weights have very similar needs. So you can't just double your RDIs for each nutrient if you weigh twice as much as the median adult of your age and sex (even if we overlook that people weighing the same can differ in many respects, notably body fat).

#### Q. Isn't soy protein bad for males?

Phytoestrogens are plant compounds structurally similar to estradiol, the main <u>estrogen</u> in males and premenopausal females. Because soy contains <u>isoflavones</u>, a type of phytoestrogen, concern has been raised about soy affecting male health.

To this day, two case reports have documented adverse effects (gynecomastia, hypogonadism, reduced libido, and erectile dysfunction) from an estimated 360 mg of soy isoflavones per day for 6–12 months. However, a meta-analysis of 15 *randomized controlled trials* (RCTs, a much higher level of evidence than case reports) found that males' levels of total and free testosterone were not notably affected by either 60–240 mg of isoflavones or 10–70 grams of soy protein per day.

Accordingly, a couple of scoops of soy protein powder are unlikely to have estrogenic effects in males. If you'd like to take more, however, look for a soy protein concentrate or isolate produced through the <u>alcohol-wash method</u>, which dramatically lowers the isoflavone content.<sup>[54]</sup>

Keep in mind that the isoflavone content of different soy products can vary depending on several factors, such as the variety of soybeans used, differences in growing and storage conditions, and differential food processing techniques employed. You can see how it varies below

#### Isoflavone content of common soy foods

Food category	Food	Milligrams of isoflavones per 100 g of food		
		Average	Minimum	Maximum
Traditional unfermented soy foods	Edamame	18	14	19
	Soybeans (boiled)	65	23	128
	Soybeans (raw)	155	10	440
	Soybean sprouts	34	0	107
	Soy milk (unsweetened)	11	1	31
	Soy nuts	148	2	202
	Tofu	30	3	142
	Miso	41	3	100
Traditional fermented soy foods	Miso soup	1.5	1.5	1.5
	Miso soup mix (powder)	70	54	126
	Natto	82	46	124
	Soy sauce	1	0	3
	Tempeh	61	7	179
Second-generation soy foods	Soy-based veggie "meats"	9	0	23
	Soy cheeses	26	3	59
	Soy yogurt	33	10	70
Soy flours and protein powders	Soy flour (defatted)	151	74	324
	Soy flour (full-fat)	165	130	260
	Soy infant formula (powder)	28	21	31
	Soy protein concentrate (alcohol wash)	12	2	32
	Soy protein concentrate (water wash)	95	61	167
	Soy protein isolate	91	46	200

Reference: USDA FoodData Central Databases. Accessed Jan 18, 2019. https://fdc.nal.usda.gov/

### Q. Don't dietary proteins reduce bone density?

More protein in the diet has been linked to more <u>calcium</u> in the urine. Two reasons have been suggested to explain this phenomenon. Your body draws from its calcium stores (in bones) to buffer the acid load caused by dietary protein. This has led researchers to suggest that higher protein intake could increase bone loss. [56]

Most studies that looked at protein intake and calcium excretion list dairy products as a protein source, [57]

so higher urinary calcium could simply be the result of higher calcium intake (i.e., more calcium in, more calcium out).

Therefore, looking only at calcium *excretion* wasn't enough. Subsequent studies showed that dietary protein promotes dietary-calcium absorption<sup>[58]</sup> and that high protein intake "promotes bone growth and retards bone loss whereas low-protein diet is associated with higher risk of hip fractures." High-protein diets have also been shown to modestly suppress the decrease in bone mineral density caused by weight loss. [60]

What happens is that when you ingest more protein, you absorb more of the calcium in your food, so less calcium ends up in your feces. Later, your body gets rid of the calcium it doesn't need, so more calcium ends up in your urine, but not as much as would have otherwise ended in your feces. Therefore, an increase in protein intake leads to an overall decrease in calcium excretion, which points to an increase in calcium retention. High-protein diets also raise your *insulin-like growth factor-1* (IGF-1), which promotes notably bone growth.

All in all, current evidence suggests that protein's effect on bones is either neutral or beneficial.[61][64]

# Q. Should I continue using white willow bark if it aggravates my heartburn?

No, you shouldn't. Although a study reported that, "in contrast to synthetic aspirin, willow bark [did] not damage the gastrointestinal mucosa" (probably thanks to some phenolic compounds in the plant), there is still a risk of it exacerbating stomach ulcers. Keep in mind that your body metabolizes salicin into salicylic acid, a close cousin of acetylsalicylic acid (aspirin), which several studies have shown can damage the lining of the digestive tract.

#### Q. Why isn't ephedrine included in this guide?

<u>Ephedrine</u>, an alkaloid from the plant *Ephedra sinica*, cannot be marketed as a fat burner. Its sale is prohibited or restricted in various countries, so it cannot be recommended in this guide.

Synephrine is similar to ephedrine. It is a safer compound, though it is also less effective.

### Q. Why isn't DNP included in this guide?

DNP (2,4-dinitrophenol) is most often sold as an herbicide or a pesticide; it cannot legally be sold as a food supplement. Ingested, it creates a leak in the energy pathway of mitochondria, the ATP generators in our cells, so that everything you do, from exercising down to breathing, burns more calories (as heat). For that reason, DNP has been studied as a potential obesity drug, and it has proven very effective. Alas, the adverse effects include dysgeusia (a distortion of the sense of taste), cataracts, and death. Because the efficacious dose and the lethal dose are very close and vary between individuals, even what was once considered a safe dosage has killed.

Since our bodies all react differently, and since the line between the efficacy and lethality of DNP is thin, what was safe for your friend may not be safe for you. At any dose, taking DNP is very much like playing Russian roulette.

#### Q. Is there a "best diet" for fat loss?

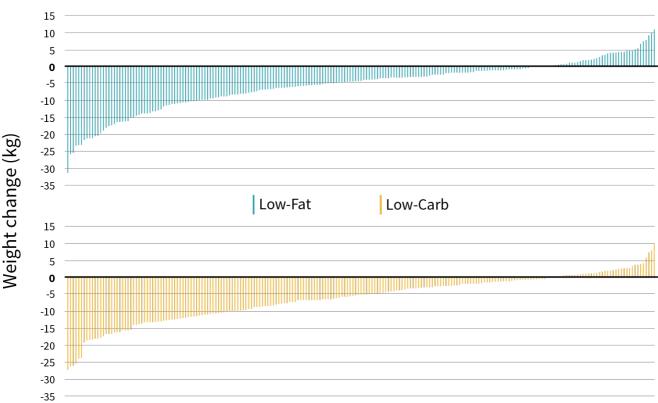
Usually, in diet studies, weight loss differs little *between* diet groups but a lot *within* each group. In other words, individual results will vary. Let's use as an example the *D*iet *I*ntervention *E*xamining *The F*actors *I*nteracting with *T*reatment *Success* (DIETFITS) RCT, for which 600 participants were randomly assigned to either a low-fat or low-carb (non-keto) diet for 1 year, with intensive support from dietitians and research staff. (You can read our detailed review of this 2018 study here.)

Here were the reported weight-loss averages:

- 5.3 kg (11.7 lb) in the *low-fat* group
- 6.0 kg (13.2 lb) in the low-carb group

As you can see in the figure below, in which each bar represents the weight change of a single participant, individual changes were all over the place in *both* groups: they ranged from -32 to +11 kg (-70 to +24 lb).

#### 12-month weight change for each DIETFITS participant



Adapted from Gardner et al. JAMA. 2018. [66]

One reason is simply that some people stick to their diets while others don't (a support network is very helpful for diet adherence), but another may be that some diets do work better for some people than for others, for reasons that aren't completely understood.

If there's one takeaway to keep in mind after looking at all the evidence, it is that no one diet is *inherently* superior. Different diets work differently for different people, but *your best fat-loss diet* will have at least two qualities: it'll be *hypocaloric* (it'll make you eat less than your burn) and *sustainable* (it'll fit *your* food preferences and lifestyle well enough that you can stick to it).

#### Q. What about intermittent fasting for fat loss?

Intermittent fasting is an eating pattern that involves alternating periods of little or no energy intake with intervening periods of normal food intake, on a recurring basis. The scientific literature on the effects of intermittent fasting on health and body composition is steadily growing, but differences between studies relating to populations used, intermittent fasting protocols employed, study durations, and so on, mean that it's difficult to compare studies and draw firm conclusions.

#### Common types of fasting regimens

ТҮРЕ	FAST	FEED	DURATION
Alternate Day Fasting	36-hour fast	12-hour feed	Every other day
Eat Stop Eat	Full-day fast	1–2 days per week	1–2 days per week
Warrior Diet	20-hour fast	4-hour feed	Every day
Lean Gains	16-hour fast	8-hour feed	Every day
5:2 Diet	500-600 kcal per fast day	5 consecutive days per week	2 successive days per week

Studies in animals and humans suggest that intermittent fasting can reduce weight and fat mass, and may improve several markers of health. Yet, current evidence suggests that intermittent fasting and continuous energy restriction result in similar reductions in body weight and fat mass. [67][68][69] The results recent systematic review and meta-analysis also seem to confirm the above conclusions. [70][71][72]

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