Nutrivore

QUICKSTART Guide

By Dr. Sarah Ballantyne, Phd

A radical yet simple idea: *get all the nutrients we need from the food we eat.*

Disclaimer:

The information provided in "The Nutrivore Quickstart Guide" is intended for educational and informational purposes only. It is not intended to be a substitute for professional medical advice, diagnosis, or treatment. Always seek the advice of your physician or other qualified health provider with any questions you may have regarding a medical condition. Never disregard professional medical advice or delay in seeking it because of something you have read in this eBook.

The author and publisher of this eBook, as well as Nutrivore.com, do not assume any responsibility for any liability, loss, or risk incurred as a consequence of the use of any of the content provided. The reader agrees to indemnify and hold harmless the author, publisher, and website from and against any damages, costs, and expenses, including any legal fees arising from or related to the use of the information contained in this eBook.

Copyright Notice:

Nutrivore Quickstart Guide

By Dr. Sarah Ballantyne, PhD

About Dr. Sarah:

Award-winning public speaker, New York Times bestselling author and world-renowned health expert, Dr. Sarah Ballantyne, PhD believes the key to improving public health is scientific literacy. She creates educational resources to help people improve their day-to-day diet and lifestyle choices, empowered and informed by the most current evidenced-based scientific research.

Dr. Sarah began her career as a science communicator and health educator when she launched her original website in 2011. On this platform, Dr. Sarah combined her background in medical research with her experience using diet and lifestyle to mitigate a dozen diagnosed health conditions to create a wealth of educational resources and amass an audience of millions. Since then, Dr. Sarah has continued to follow the science—diving deep into immune health, metabolic health, gut microbiome health, nutritional sciences, and the compelling evidence for health at any size—while also observing the harm of healthism, diet culture, dogmatic misinformation and predatory marketing. With Nutrivore, Dr. Sarah seeks to create a positive and inclusive approach to dietary guidance, based in science and devoid of dogma, using nutrient density and sufficiency as its basic principles: Nourishment, Not Judgement.

Table of Contents

What Is a Nutrivore?

Nutrivore

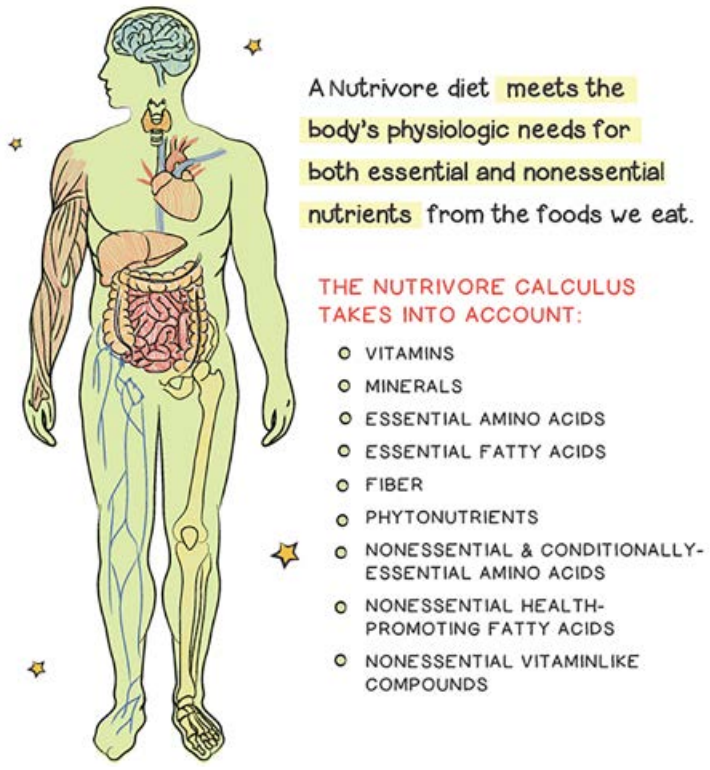
no͝o-trĭ-vôr′ *noun*

1. A person who chooses foods to supply all the nutrients their body needs to thrive.
2. A diet predominantly comprised of nutrient-dense whole foods.
3. A radical yet simple idea: Get all the nutrients we need from the food we eat.

Nutrivore is a dietary philosophy where the goal is to get all of the nutrients our bodies need from the foods we eat. Instead of labeling foods as "good" or "bad", we look at the overall quality of the whole diet, choosing foods such that the sum total of all the nutrients those foods contain throughout the day add up to meet the daily demands of our body, but without consuming excess energy (i.e., staying within daily caloric requirements). By including the full cadre of both essential and nonessential (but still important) nutrients into the nutrition calculus, we are ensuring both nutrient synergy as well as prioritizing the full complement of nutrients our bodies need to thrive.

> Being a Nutrivore is about the overall quality of the whole diet, and not about a list of yes-foods and no-foods.

Even though reducing consumption of "empty calorie" foods helps to achieve nutrient sufficiency without overeating, no food is strictly verboten. In this way, Nutrivore is a diet modifier rather than a diet itself—a Nutrivore approach can be layered atop of other dietary structures and priorities in order to meet an individual's specific health needs and goals. For example, you can follow a Nutrivore Paleo diet, or a Nutrivore Mediterranean diet, or a Nutrivore plant-based diet. You can also apply the Nutrivore philosophy to anti-diet culture; and in fact, it's completely aligned with the body positivity movement. Even though some individuals may still need to eliminate food sensitivities that trigger reactions or chronic disease symptoms, or may choose to eliminate certain foods to conform to a specific dietary structure, this in no way prevents us from adopting a Nutrivore diet, although it may necessitate thoughtful selection from the included foods.



We measure success on Nutrivore by asking whether all of the foods you eat altogether supply your body with the nutrients it needs. Furthermore, because we are able to store at least a modest amount of most nutrients, the goal isn't even nutrient sufficiency for the whole diet on a daily basis, but rather nutrient sufficiency on average. It's okay if you don't reach the Recommended Dietary Allowance (RDA) for zinc one day; but, it's a good idea to troubleshoot and find a way to incorporate more zinc-rich foods into your diet if you find yourself falling short most days. So, we're looking at the collective nutritional contribution of all of the foods we eat, i.e., Nutrivore is about the whole diet.

Why evaluate the quality of the whole diet rather than each individual food you eat, like most diets do?

> First, there's no such thing as a nutritionally-complete food or food group; meaning there's no single food that provides all of the nutrients we need to thrive.

As an extreme example, what if you decided to only eat watercress because it's one of the most nutrient-dense foods in the world? Well, you'd get impressive amounts of vitamin C, vitamin K, and phytonutrients (especially carotenoids and glucosinolates), and if you ate enough of it (285 cups of watercress would get you to 2000 calories), you could reach the RDA of most vitamins and minerals. But, you'd still be lacking in vitamin D, vitamin B12, choline, omega-3 fats, and some essential amino acids, especially methionine and tryptophan. You'd also miss out on the full diversity of polyphenols as well as some functional compounds that just aren't available in watercress, like taurine, carnitine, carnosine, creatine, ergothioneine and thiosulfinates. Eventually, you'd develop megaloblastic anemia due to vitamin B12 deficiency (in contrast, pernicious anemia causes vitamin B12 deficiency), plus symptoms such as increased pain sensitivity and aggression due to tryptophan deficiency, and dementia from methionine deficiency. Yes, it's an extreme example, but it helps drive the point home that we necessarily must eat a variety of different foods that supply complementary nutrition in order to get the full range of nutrients that our bodies need.

Second, foods can fill important nutritional niches in a diet without being objectively nutrient dense. A great example of this is white rice, which is totally underwhelming from a nutrient density perspective, yet research has shown that white rice can indeed contribute to good health. This is thanks to its resistant starch content, which has significant prebiotic activity, meaning it feeds probiotic bacteria in our guts, greatly benefiting gut and, by extension, overall health. In fact, steamed rice consumption is associated with reduced risk of cardiovascular disease.

Furthermore, not every food you eat needs to be the pinnacle of nutrient density in order for your whole diet to deliver sufficient nutrition. Yes, there's room in a healthy diet for empty calories—let's call them quality-of-life foods! With Nutrivore, we care about whether your nutritional needs are met overall by your whole diet—if you got all the nutrients your body needs with those other healthier food choices, then who cares that you enjoyed a treat or two that was more about emotion or flavor than nutrients? No one food will make or break your diet or stop you from reaching your health goals.

Why Is Nutrivore Important?

Most people's diets fall short of meeting their nutritional needs, and the result is most people have one or more nutrient insufficiencies. Nutrient insufficiency (or inadequacy) is defined as usual dietary intake falling below the Estimated Average Requirement but without clear disease of malnutrition, like scurvy or rickets.

> The concern is that nutrient insufficiencies are increasingly showing up as a major underlying driver of chronic disease.

A 2011 study evaluated American's usual nutrient intake including nutrients that are naturally-occurring in foods, from fortified and enriched foods, and from supplements. The results are astounding. The table below shows the proportion of American adults whose usual diet falls short of essential vitamins and minerals.

Prevalence of Nutrient Insufficiencies

Nutrient	Proportion of American adults consuming less than the Estimated Average Requirement
VITAMIN D	100%
POTASSIUM	97.8%*
VITAMIN E	96.2%
VITAMIN B9 (FOLATE)	90.2%*
VITAMIN A	80.1%
VITAMIN K	72.4%*
MAGNESIUM	66.3%
VITAMIN B1 (THIAMIN)	56.3%
CALCIUM	54.9%
VITAMIN C	52.0%
VITAMIN B6 (PYRIDOXINE)	25.5%
IRON	23.1%
ZINC	16.8%
VITAMIN B3 (NIACIN)	11.7%
VITAMIN B2 (RIBOFLAVIN)	9.6%
VITAMIN B12 (COBALAMIN)	7.2%
COPPER	5.4%
PHOSPHORUS	2.0%
SELENIUM	1.1%

Adapted from Fulgoni, V. L., 3rd, Keast, D. R., Bailey, R. L., and Dwyer, J. 2011. "Foods, fortificants, and supplements: Where do Americans get their nutrients?." The Journal of nutrition, 141 (10), 1847–1854.doi: 10.3945/jn.111.142257

**Vitamin K and potassium do not have Estimated Average Requirements established. For these two nutrients, the number in the table above is the percentage of people who are not consuming the Adequate Intake level.*

When we are short on nutrients, the biological processes that rely on those nutrients can't function like they normally do. This might mean a chemical reaction is less efficient, producing less product than is required; or, an alternate pathway might be necessary, but it creates a product that isn't as good or a byproduct that is undesirable or even toxic. It might mean more wear and tear on our cellular machinery, and a hampered ability for our cells and tissues to regenerate, rejuvenate, and repair. When the nutrient shortfalls are ongoing, strain builds up on the biological systems that require them, causing that entire biological system—like the cardiovascular system, the central nervous system, the musculoskeletal system, the digestive system, and the reproductive system, to name a few—to not work quite as well as it's supposed to. This sets the stage for an eventual chronic condition, when enough damage has built up due to lack of nutritional resources.

In comparison to nutrient deficiencies which cause diseases of malnutrition, nutrient insufficiencies are a nickel and diming effect, where the nutrient shortfall isn't bad enough to cause a disease of deficiency, but instead is chipping away at your health, increasing your risks for every disease and symptom under the sun, from type 2 diabetes to cancer, cardiovascular disease to Alzheimer's disease, headaches to PMS, asthma to osteoporosis, fatigue to increased susceptibility to infection.

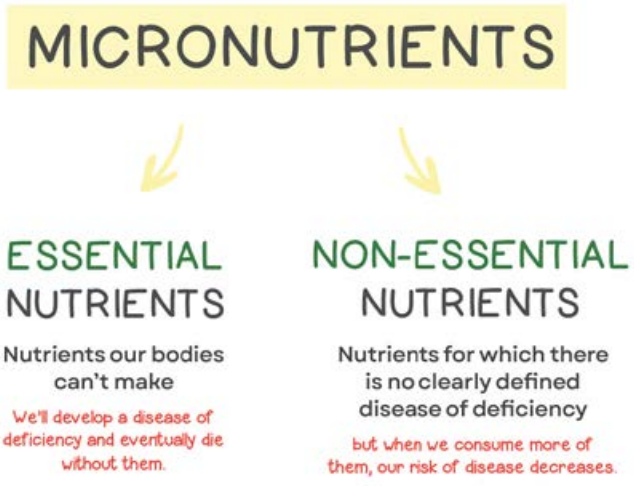
Becoming Nutrient Aware

> Nutrivore is not a diet itself, but rather a general nutritional sciences education that can help inform your day-to-day choices so that you can meet the Nutrivore goal of getting all of the nutrients your body needs from the foods you eat.

By deepening your understanding of what nutrients do in the body and which foods supply them, you can apply Nutrivore principles atop other dietary structures, intuitive eating, or anti-diet, thereby increasing your consumption of vital nutrients that are essential for your health.

Nutrients are those substances within the foods we eat that provide nourishment essential for growth and the maintenance of life. Every cell, tissue, organ, and system in the human body needs specific amounts of select nutrients in order to function efficiently and effectively. Nutrients are used not only in the formation of the components of our bodies but also in the millions of chemical reactions that occur in our bodies in every moment. We are made of nutrients and our bodies use them up in everything our bodies do, even basic things like breathing.

Nutrients which can be broadly categorized as *macronutrients*, those we need in large quantities, and *micronutrients*, those we need in smaller quantities. Macronutrients—protein, fat, and carbohydrates—supply the energy that fuels the complex functions of life along with being basic building blocks for cellular structures. Micronutrients—vitamins, minerals, plant phytonutrients, and other compounds—can also be incorporated into cellular structures, but more commonly are necessary resources that facilitate or get used up in cellular chemical reactions.



Micronutrients can be categorized as essential and nonessential. Essential nutrients are those that our bodies can't make—we'll develop a disease of deficiency and eventually die without them. Because diseases of deficiency can be studied in detail, it is easy to establish Recommended Daily Intake levels of essential nutrients, the minimum amount of that specific nutrient needed to meet the nutritional needs of 97.5% of the population (the remaining 2.5% needing more). Being even slightly deficient in a single essential nutrient can have negative consequences for our health. In contrast, nonessential nutrients are those for which there is no clearly defined disease of deficiency—we'll go on living without them, perhaps because

our body can synthesize them to some degree or because other nutrients can perform similar functions, though we may not be particularly healthy if we don't get enough. Indeed, many nutrients that are considered nonessential are known to improve health the more of them we eat. When you think about it in these terms, it's easy to realize that even nonessential nutrients are really important.

Our nutrient stores must be continuously topped up from the foods we eat. Unfortunately, getting all of our required nutrients from food is easier said than done, and this is where becoming a Nutrivore comes in.

Despite the long-established Recommended Daily Intake levels of essential nutrients and the increasing awareness of the importance of non-essential nutrients (like CoQ10 and polyphenols), no mainstream nor fad diet, nor government dietary guideline, has ever fully integrated the concept of completely meeting our nutritional needs from the foods we eat. But, that doesn't mean that we can't integrate the Nutrivore philosophy into these diet plans!

In fact, there's myriad combinations of foods we can eat in a day that will supply the full complement of nutrients that our bodies need to thrive. Yes, you get to customize your food choices to not only fit your preferred diet but also your food preferences, budget, and how much time you have to prepare foods. But, doing so does require nutrient awareness, meaning some basic knowledge of what nutrients do in the body, what foods contain them, and how to combine nutritionally-complementary foods in order to get the full range of nutrients your body needs. The great news is that, once you have this basic knowledge, you can choose foods within your preferred dietary framework to easily improve the nutritional quality of your diet.

So let's jump into a tour of both essential and nonessential nutrients, what they do in the body, and what foods are the best sources.

A Tour of Essential and Nonessential Nutrients

> Nutrients are broadly categorized by their chemical structure and biological activity.

Let's take a tour of the vast array of nutrients, both essential and nonessential, that support every system in the human body.

Carbohydrates

Carbohydrates (including sugar, starch and fiber) are a class of organic molecules with the basic structural components being sugar molecules, or *saccharides*, which have a general molecular formula of $C_m(H_2O)_n$. Their two main roles in supporting health are as an energy source and as fermentable substrate for the gut microbiome.

CARBOHYDRATES

- MONOSACCHARIDES - 1 sugar molecule
- DISACCHARIDES 2 sugar
- OLIGOSACCHARIDES medium w/ 3-10 sugar molecules
- POLYSACCHARIDES Long chain, can be 100+ long

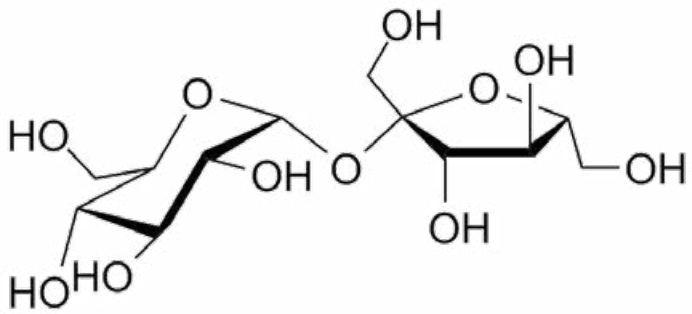
Chemically, carbohydrates are classified based on the number of saccharides they contain: MONOSACCHARIDES are made up of a single sugar molecule (examples are glucose and fructose), DISACCHARIDES contain two sugar molecules (examples are sucrose and lactose), OLIGOSACCHARIDES are medium-length chains of three to ten sugar molecules, and POLYSACCHARIDES are long chains of sugar molecules that can be hundreds long (think of polysaccharides of long chains of monosaccharide units; therefore, they can be broken down in our digestive system into simple sugar molecules, either by our own digestive processes or by our gut bacteria).

From a dietary perspective, however, it's more relevant to classify carbohydrates based on how they're digested and absorbed:

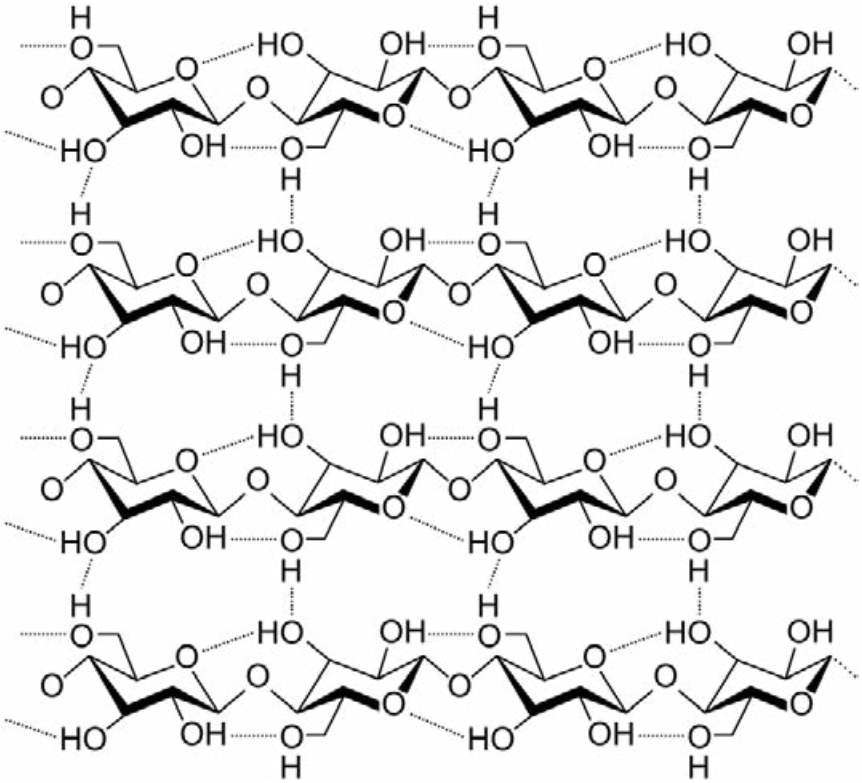
- SUGARS, also called *simple carbohydrates* or simple sugars, include monosaccharides like glucose, fructose and galactose, and disaccharides like sucrose (one fructose and one glucose), lactose (one glucose and one galactose) and maltose (two glucoses). Sugars give food a sweet taste and are naturally found in fruit, dairy products and natural sweeteners like honey and cane sugar. They are digested and absorbed quickly and the glucose they contain has a rapid impact on blood sugar levels and insulin secretion.

- STARCHES are *complex carbohydrates*, polysaccharides composed predominantly of glucose. Starch is produced by most plants as an energy storage molecule and is commonly found in grains, legumes, and root vegetables such as potatoes, sweet potatoes, and cassava. Starch takes longer to break down during digestion and has a more gradual impact on blood sugar levels.
- FIBER is also a complex carbohydrate, oligosaccharides and polysaccharides from plant cell walls that don't get fully broken down by our digestive enzymes and instead are fermented by the bacteria and other microorganisms that live in our digestive tracts. Fiber can be further divided into a few major classes based on molecular structure, including: cellulose, hemicellulose, pectin, lignin, chitin,

SUCROSE (A.K.A. TABLE SUGAR) IS A DISACCHARIDE COMPOSED OF TWO MONOSACCHARIDES: GLUCOSE (LEFT) AND FRUCTOSE (RIGHT)



A STRAND OF CELLULOSE, MADE UP OF HUNDREDS TO THOUSANDS OF D-GLUCOSE MOLECULES LINKED TOGETHER



Whole-food sources of carbohydrates, like fruits and vegetables, contain a mix of simple and complex carbohydrates, including fiber which slows down digestion and blunts the blood sugar response. Blood sugar regulation is further improved by ingesting fruits and vegetables as part of a complete meal that also includes protein and fats.

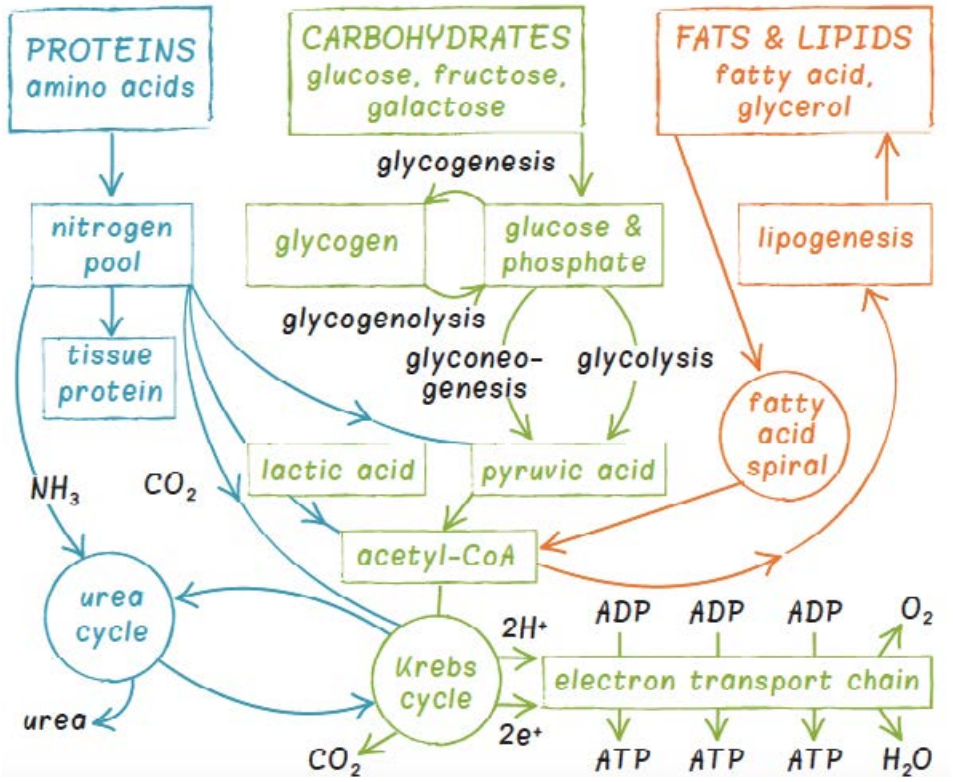
Refined carbohydrates refer to carbohydrates that have been processed. For example, when the bran and germ are milled away from whole grains to make refined grain products, most of the fiber is removed. The resultant starches are digested and absorbed rapidly, sometimes raising blood glucose levels as quickly as simple sugars. Examples are white flour made from whole wheat, white rice made from brown rice, table sugar made from whole sugar cane or sugar beets. Simple sugars can also be refined. A prominent example of a processed sugar is high fructose corn syrup. In this case, corn syrup is treated with enzymes to turn a proportion of the syrup's glucose into fructose. Refined carbohydrate sources contain little to no nutritional value since most, if not all, of the valuable vitamins, minerals, and phytonutrients are also removed as part of the refining process.

When we consume non-fiber carbohydrates, our digestive system first breaks complex carbohydrates down into monosaccharides (mainly glucose molecules), which are absorbed into our blood stream, causing a resulting rise in our blood sugar levels, (a.k.a. blood glucose levels). In response to that rise in blood sugar, the pancreas releases the hormone insulin, which facilitates the transport of glucose into the cells of the body and signals to the liver to convert glucose into glycogen for short-term energy storage in liver and muscle tissues and into triglycerides for long-term energy storage in adipose tissues. Insulin sensitivity can be maintained with adequate sleep, activity and stress management along with avoiding frequent excessive consumption of simple carbohydrates that can cause maladaptation to chronically elevated blood glucose levels.

Once inside our cells, glucose is an energy source, being rapidly converted into ATP, the energy currency for all cells, via the *Kreb's cycle* (a process that also uses oxygen and produces carbon dioxide, also called the *Citric Acid Cycle* or *Cellular Respiration*). Many ATP molecules can be formed from a single glucose molecule. Glucose molecules are first converted into pyruvate via glycolysis which yields some ATP. Pyruvate then enters the mitochondria where it is oxidized into acetyl-CoA, which can also yield some ATP. Acetyl-CoA is then converted into more ATP in the Krebs, an 8-step process involving 18 different enzymes and co-enzymes. Other high-energy products of the Krebs cycle (NADH and $FADH_2$) are converted into yet more

ATP in the last step of cellular respiration, oxidative phosphorylation in the electron transport chain. This is complex biochemistry; the important part here is that there's a whole lot of chemical reactions required to make sugar into a useable energy source for our cells!

METABOLISM SUMMARY

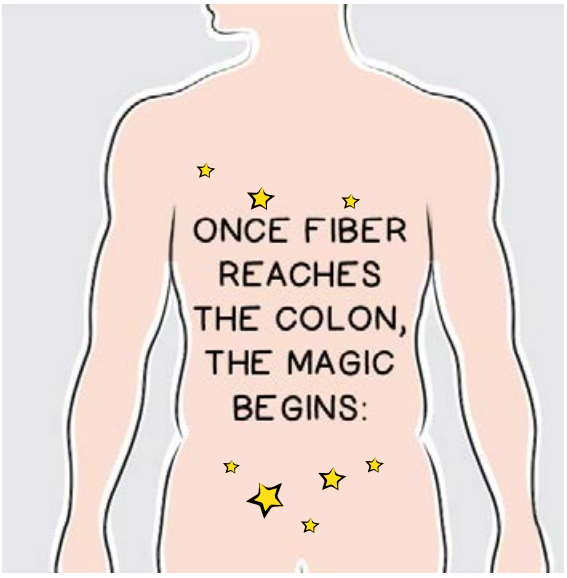


Glucose isn't the only molecule that can be converted into ATP via cellular respiration. Protein (amino acids), fats (fatty acids and glycerol), and other carbohydrates (like fructose) can be converted to various intermediates of glycolysis, pyruvate oxidation and the Krebs cycle, allowing them to slip into the cellular respiration pathway at multiple points. However, glucose is the easiest to convert into ATP (it requires the least amount of oxygen and can even produce some ATP anaerobically) so it is the preferred fuel for cells. In between meals, once the glucose that enters the bloodstream has been used up, cells metabolize stored fat and glycogen (stored carbohydrates) for energy. A flexible metabolism is one that can easily switch between carbohydrates and fats, depending on what's available. Although protein is not a preferred source of energy, it can be used if needed—this is why people lose muscle mass in addition to fat stores when they are too severely calorically restricted, fasting, or starving.

Fiber

> Fiber is the quintessential example of a nutrient that isn't labelled as essential but that is absolutely fundamental for our health.

What separates fiber from other carbohydrates is that the ways the constituent saccharides link together are not compatible with our digestive enzymes; our bodies just aren't capable of breaking apart those types of molecular bonds. Instead, fiber passes through the digestive tract mainly intact. And once it reaches the colon, the magic begins: fiber serves as a substrate for a wide range of bacteria, including some of the most important species we can harbor!



Many of the health benefits attributed to fruits, vegetables, nuts, legumes, and whole grains are due to the way the fiber in these foods impact the gut microbiota.

The term *gut microbiota* refers to the massive collection of microorganisms that inhabit our gastrointestinal tract. And "massive" is far from hyperbole: an estimated 30-100 trillion bacteria (along with fungi, viruses, and archaea) comprise the microbiota, collectively weighing around 4.5 pounds and containing over 150 times more genes than our own human genome! These microbes include a mixture of commensal (neutrally existing), symbiotic (mutually beneficial, also called probiotic), and pathogenic (harmful to us) organisms, and can consist of any of 35,000 species known to inhabit the human gut. Every person's gut contains approximately 400 to 1,500 different species of the possible 35,000 different microorganisms that are well adapted to survive in the human gastrointestinal tract, although about 99% of those microorganisms come from thirty to forty species of bacteria. Our guts are inhabited by other microorganisms besides bacteria, including archaea (similar to bacteria), viruses, and single-cell eukaryotes (like yeast).

Our gut microbes perform many different essential functions that help us to stay healthy. These include digestion, vitamin production, detoxification, regulation of cholesterol metabolism, providing resistance to pathogens, immune regulation, neurotransmitter regulation, regulation of gene expression, and more! In fact, every human cell is impacted by the activities of our gut microbes. A healthy gut microbial community is essential for our health. And, the converse is also true: An aberrant gut microbiome has been linked to conditions as wide-ranging as cancer, obesity, diabetes, cardiovascular disease, anxiety, depression, neurodegenerative diseases, autism, autoimmune disease, ulcers, IBD, liver disease, gout, PCOS, osteoporosis, systemic infections, allergies, asthma, and more!

The composition and metabolic activity of the community of microbes in our guts is influenced greatly by the foods we eat, most notably the amount and types of fiber. Most of our dietary fiber intake comes from

the cell walls of plants, where it acts like a skeleton and helps to maintain the plants' shape and structure. However, special forms of fiber are also found in edible insects and fungi.

There are many, many different types of fiber consisting of different lengths of carbohydrate strings composed of different saccharides, some with branches and some without. Most fiber types are fermentable, and in general, fiber is subdivided into soluble and insoluble forms, and can also be categorized more specifically into different polysaccharides.

- SOLUBLE FIBER forms a gel-like material in the gut and tends to slow the movement of material through the digestive system. Soluble fiber is typically readily fermented by the bacteria in the colon, producing gases and physiologically active by-products (like short-chain fatty acids and vitamins).
- INSOLUBLE FIBER tends to speed up the movement of material through the digestive system. Fermentable insoluble fibers also produce gases and physiologically active by-products (like short-chain fatty acids and vitamins). Insoluble fiber is typically fermented more slowly by gut bacteria, and consequently moves through the colon and adds bulk to the stool (which is beneficial for regulating bowel movements and managing constipation).

When probiotic bacteria eat fiber, they produce short-chain fatty acids such as acetic acid, propionic acid, and butyric acid. These are extremely beneficial energy sources for the body, including the cells that line the digestive tract, and help to maintain a healthy gut barrier. Short-chain fatty acids are also essential for regulating metabolism and aid in the absorption of minerals, such as calcium, magnesium, copper, zinc, and iron.

Fiber has other effects, like regulating peristalsis of the intestines (the rhythmic motion of muscles around the intestines that pushes food through the digestive tract), stimulating the release of the suppression of the hunger hormone ghrelin (so we feel more full), and slowing the absorption of simple sugars into the bloodstream to regulate blood sugar levels and avoid the excess production of insulin. Fiber also binds to various substances in the digestive tract (like hormones, bile salts, cholesterol, and toxins) and, depending on the type of fiber, can facilitate either elimination or reabsorption (for the purpose of recycling, which is an important normal function for many substances like bile salts and cholesterol), both of which can be extremely beneficial—if not essential—for human health.

So even though fiber doesn't provide us with energy (like other carbohydrates, fat, and protein) and isn't an essential nutrient, it's pretty darned important; in fact, one might argue that it's classification as nonessential is erroneous.

Diets rich in fiber also reduce the risk of many cancers (especially colorectal cancer, but also liver, pancreas, and others) and cardiovascular disease, as well as lower inflammation overall. Prospective studies have confirmed that the higher our intake of fiber, the lower our inflammation (as measured by C-reactive protein). In fact, a recent study showed that the *only* dietary factor that correlated with incidence of ischemic cardiovascular disease is low fiber intake (not saturated fat!); the more fiber we eat, the lower our risk. If someone has kidney disease, a high-fiber diet reduces their risk of mortality. If someone has

diabetes, a high-fiber diet reduces their risk of mortality. A high fiber intake can even reduce the chances of dying from an infection.

It's also important to eat a diversity of fiber types, which in practice translates to consuming a wide variety of fresh whole fruits, vegetables, mushrooms, nuts, seeds, and legumes. Even among fibers of the same class, differences in the fine-level structure can impact the interaction with the microbiota. Researchers have pointed to the idea of unique chemical arrangements called "discrete structures" that exist within fiber molecules, and which align with encoded gene clusters in bacterial genomes. These discrete carbohydrate structures (which likely number in the thousands!) provide nutrient niches for bacteria, triggering the expression of bacterial enzymes depending on the "cues" contained within the unique fiber structure. The huge number of potential fiber structures is due to a combination of basic differences in fiber types, variations in genotype and growing environment of the plants, subsets of structures within polymers, linkage types, alterations in fiber taken from different anatomical parts of the plant, carbohydrate chain length, and particle size—among other factors! As a consequence, fibers that vary even in seemingly minor ways might favor fermentation by bacteria down to the strain level, creating highly complex interactions. These extremely specific fiber-microbiota connections will require much more detailed research before we fully understand them.

A good rule of thumb is to aim to eat at least 30 different plant foods per week. An important 2018 study compared the gut microbiome of people who regularly ate less than 10 different plant foods per week versus those who routinely ate 30 or more. Gut microbiome diversity was significantly higher in individuals consuming 30 or more types of plants and those consuming more fruits and vegetables generally, and their guts featured a wide variety of probiotic species well-documented to improve health as well as fewer antibiotic-resistant bacteria. In addition, individuals who consumed the widest variety of plants had microbiomes that produced higher levels of beneficial metabolites, including conjugated linoleic acid.

AIM TO EAT AT LEAST 30 DIFFERENT PLANT FOODS PER WEEK.

Starch and the Gut Microbiome

No RDA is established for total carbohydrates; however, the Acceptable Macronutrient Distribution Range (AMDR) for carbohydrates is estimated to be between 45% to 65% of total energy (and below 25% from sugars). Because starch takes longer to break down during digestion than sugars—especially when consumed as part of a meal that includes fiber, protein and fat—it has a gradual impact on blood sugar levels, often referred to as a slow-burning carbohydrate. This means that starch from whole food sources (like root vegetables and legumes) is a healthier carbohydrate choice for insulin resistance and diabetes;

but also, emerging evidence makes a strong case for moderate (not low) starch consumption to support a healthy gut microbiome.

When we consume digestible carbohydrates, they are broken down into simple sugars (mostly glucose) by our digestive enzymes and absorbed into our blood stream. But, each day, between about 20 and 60 grams of dietary carbohydrates, mostly starches, escape degradation by our digestive enzymes and instead enter the colon. This is in addition to indigestible carbohydrates like resistant starches, plant cell wall polysaccharides and non-digestible oligosaccharides (i.e., fiber), and some di- and mono-saccharides (like sugar alcohols) that are resistant to digestion and/or absorption. Once in the large intestine, dietary starch is readily fermented by probiotic bacteria species.

An important 2019 study evaluating the effects of a long-term low-carb Paleo diet on the gut microbiome showed that around 90 to 100 grams of carbohydrate per day was not sufficient to promote the growth of some key probiotic strains, including *Bifidobacterium* and *Roseburia* species, despite adequate fiber intake of around 27 to 29 grams daily. The control group, with a much healthier microbiome, consumed approximately double the carbohydrate grams daily (and three times the amount of starch) and about the same amount of fiber. The authors further showed that resistant starch, which is abundantly found in starchy root vegetables and legumes, correlated most strongly with gut microbiome composition.

In addition, studies of the ketogenic diet have shown very concerning impacts on gut microbiome composition as well, attributable to inadequate carbohydrate consumption compounded with inadequate fiber intake.

An exact minimum carbohydrate intake is hard to pinpoint, but something closer to 150 to 200 grams daily is a good starting point (especially from nutrient-dense whole foods, including fruit, vegetables, and legumes). And, provided carbohydrates are coming from whole-food sources, even up to 300 grams (based on a 2,000 calorie per day diet) is associated with health benefits.

Fats and Fatty Acids

> Fats are a type of *lipid*, which is broadly defined as a molecule that is insoluble in water but that dissolves in organic solvents like ether and chloroform.

Lipids encompass fats and oils, fatty acids, phospholipids, and sterols like cholesterol.

LIPIDS PERFORM THREE PRIMARY BIOLOGICAL FUNCTIONS WITHIN THE BODY:

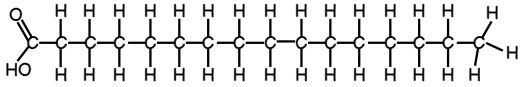
1. They serve as structural components of cell membranes,
2. They are an energy storage molecule and some can be directly used for energy,
3. They function as important signaling molecules, including forming the backbone of autocrine (within a cell) and paracrine (between neighboring cells) signaling molecules as well as steroid hormones and vitamin D.

Fats and oils, more technically called *triglycerides* (or triacylglycerol), are composed of three fatty acids

linked together (esterified) by a glycerol molecule. Each fatty acid consists of a bunch of hydrocarbons (a carbon atom bonded with one to three hydrogen atoms, the number of which varies for different fats) bonded together in a string, called the *hydrocarbon chain*, with a carboxyl group at one end, the molecular formula of which is COOH (one carbon atom bound to two oxygen atoms and a hydrogen atom). Short-chain fatty acids are those with fewer than 6 carbon atoms in the hydrocarbon chain; notable examples of which include acetic acid (2-carbon), propionic acid (3-carbon), and butyric acid (4-carbon). Medium-chain fatty acids are those with 6 to 12 carbon atoms in the hydrocarbon chain, and include caproic acid (6-carbon), caprylic acid (8-carbon), capric acid (10-carbon), and lauric acid (12-carbon). Long-chain fatty acids are those with more than 12 carbon atoms in the hydrocarbon chain; some notable examples of which are linoleic acid (18-carbons), alpha-linolenic acid (18-carbon), oleic acid (18-carbon), eicosapentaenoic acid (20-carbon) and docosahexaenoic acid (22-carbon).

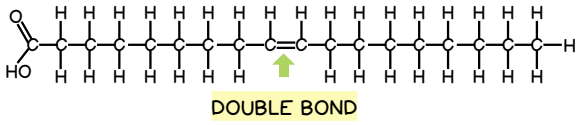
Beyond being categorized based on the length of the hydrocarbon chain, fatty acids are broadly categorized as saturated, monounsaturated, and polyunsaturated. These terms reflect the type of molecular bond between the carbons in the hydrocarbon chain (and, therefore, also the number of hydrogen atoms bound to each carbon atom).

Saturated Fatty Acid (Palmitic Acid)



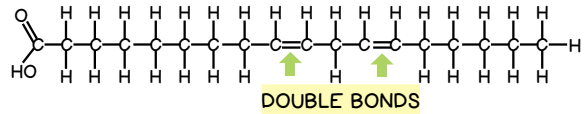
- **SATURATED FATTY ACIDS**. A saturated fatty acid is one in which all the bonds between carbon atoms in the entire hydrocarbon chain are single bonds (a simple molecular bond in which two adjacent atoms share a single electron). The carbons are then also "saturated" with hydrogen atoms, meaning that each carbon atom in the middle of the chain is bound to two hydrogen atoms. What's special about saturated fatty acids is that they are very stable and not easily oxidized (which means they are not prone to react chemically with oxygen).

Monounsaturated Fatty Acid (Oleic acid, omega-9)

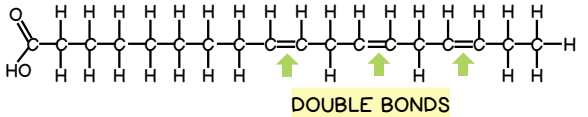


- **MONOUNSATURATED FATTY ACIDS**. A monounsaturated fatty acid is one in which one of the bonds between two carbon atoms in the hydrocarbon chain is a double bond (that is, a molecular bond in which two adjacent atoms share two electrons). This double bond replaces two hydrogen atoms, so the hydrocarbon chain is no longer "saturated" with hydrogen. Monounsaturated fats are less stable than saturated fats and require more enzymes to break apart in order to be used as energy than saturated fats do.

Polyunsaturated Fatty Acid (Linolenic Acid, omega-6)



Polyunsaturated Fatty Acid (Linolenic Acid, omega-3)



- **POLYUNSATURATED FATTY ACIDS**. A polyunsaturated fatty acid is one in which two or more of the bonds between carbon atoms in the hydrocarbon chain are double bonds (again, replacing hydrogen atoms in the chain). Polyunsaturated fats are also broadly categorized as omega-3 fatty acids and omega-6 fatty acids. These classifications relate to the location of the first double bond in relation to the end of the hydrocarbon tail. If the first double bond is between the third and fourth carbon atoms, it's an omega-3 fatty acid. If it's between the sixth and seventh, it's an omega-6 fatty acid. Polyunsaturated fats are

easily oxidized, meaning that they are prone to react chemically with oxygen. This reaction typically breaks the fatty acid apart and produces oxidants (free radicals).

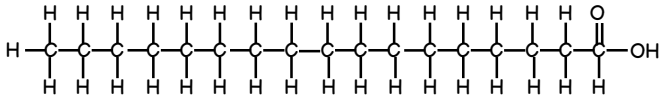
The double bond between carbons in naturally-occurring monounsaturated and polyunsaturated fats is most commonly in the *cis* configuration, where the two hydrogen atoms on either side of the bond are on the same side, putting a kink in the fatty acid. Many man-made fats and a few notable naturally-occurring *trans* fats (like conjugated linoleic acid) have double bonds between carbon atoms in the *trans* configuration, where hydrogen atoms are on opposite sides, creating a straighter molecule.

Commercially, *trans* fats are formed by taking a polyunsaturated oil (like soybean oil) and injecting it with hydrogen to make it more solid (a process called *hydrogenation*). This converts some of the *cis* double bonds to *trans* double bonds, resulting in partially hydrogenated oils that are high in *trans* fats. Because of their texture and long shelf life (saturating some of the double bonds makes these fats less susceptible to oxidation), hydrogenated oils were used extensively by food manufacturers to make cheap, shelf-stable products. The highest levels of *trans* fats are found in margarines, processed snack foods, frozen dinners, commercial baked goods, and fast food

Saturated

STEARIC ACID

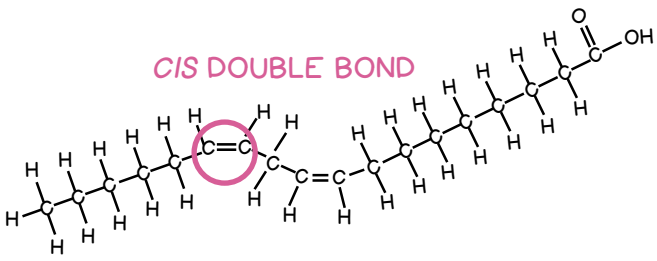
(found in butter)



Unsaturated

LINOLEIC ACID

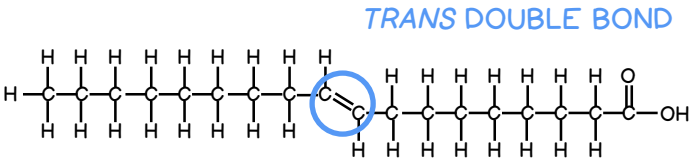
(found in vegetable oil)



Trans

TRANS-LINOLEIC ACID

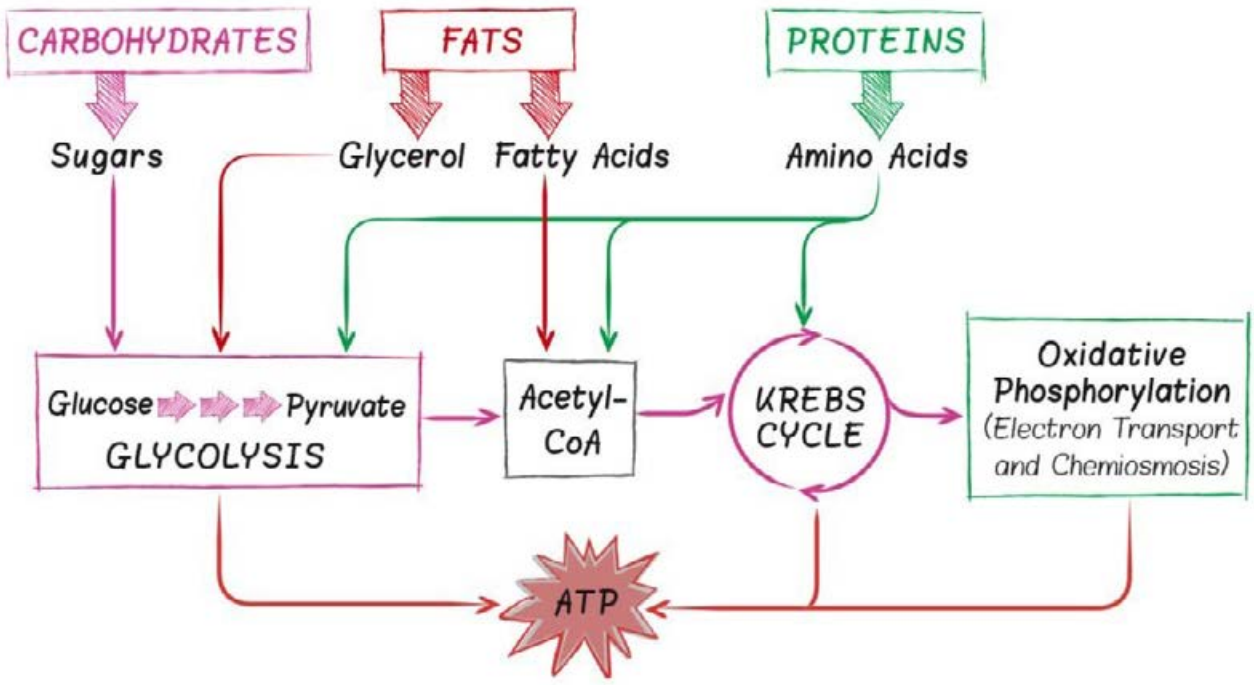
(found in some margarine)



But, what's good for the food industry isn't necessarily good for human health! In numerous studies, *trans* fats have been linked to higher LDL "bad" cholesterol, lower HDL "good" cholesterol, and higher inflammation in a dose-dependent effect (that is, the more *trans* fat we eat, the more harmful the changes in these risk factors). In mice, *trans* fats have been shown to reduce the responsiveness of a growth factor called TGF-β1 that helps control the growth, proliferation, differentiation, and apoptosis of cells. Population studies consistently link higher consumption of *trans* fats directly to heart disease. And, some research shows a link between trans fats and diabetes, likely due to the effect on insulin sensitivity and glucose transport when these fats are integrated into cell membranes. Several studies have even suggested that *trans* fats could raise the risk of certain cancers!

To use fats for energy, triglycerides must be first broken into their constituent fatty acids and glycerol molecule by lipase enzymes in a process called lipolysis. Free fatty acids can then be oxidized by a process called β-oxidation, which produces acetyl-CoA molecules that are used to generate ATP via the Krebs cycle. Short-chain fatty acids do not esterify into triglycerides but instead are rapidly oxidized into acetyl-CoA. Medium-chain fatty acids can esterify to form medium-chain triglycerides (MCTs), which have gained attention due to their unique metabolism (passively diffusing from the gastrointestinal tract into the portal system, without needing bile salts or endogenous modification). They're particularly abundant in coconut and palm oil, as well as in certain dairy fat, depending on the breed and diet of the animal.

Along with promoting fat oxidation and increasing energy expenditure, dietary MCTs have been shown to radically reduce the production of a variety of proinflammatory cytokines (meaning they reduce inflammation), increase activity of the histamine-clearing enzyme diamine oxidase (great for histamine intolerance and allergy), increase mucus production in the gut (great for gut barrier health), support gut-barrier healing (by restoring tight junction proteins to reduce intestinal permeability and by increasing cell-turnover rate in the gut), and promote a healthy gut microbiome (via selectively inhibiting pathogens). MCTs also increase the secretion of IgA antibodies in the gut (specifically in the Peyer's patches), which is considered a marker of a robust immune system (secretory IgA deficiency is linked to increased autoimmune disease risk).



Essential Fatty Acids

There are two essential fatty acids. These rather arbitrarily assigned, yet officially deemed essential fatty acids are alpha-linolenic acid (ALA; the shortest omega-3 polyunsaturated fatty acid) and linoleic acid (LA; the shortest omega-6 polyunsaturated fatty acid). The term essential is misleading here. The fatty acids with the most profound roles in the human body are arachidonic acid (AA), an omega-6 polyunsaturated fatty acid, and eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), both omega-3 polyunsaturated fatty acids. Our bodies can convert any omega-6 polyunsaturated fatty acid to any other omega-6 polyunsaturated fatty acid, and similarly can convert any omega-3 polyunsaturated fatty acid to any other omega-3 polyunsaturated fatty acid—which means that we can make EPA and DHA from ALA and AA from LA. But that conversion can be extremely inefficient, so it's important to get these from food. While ALA and LA are abundant in plant foods, AA, EPA, and DHA are found in seafood, meat, and poultry.

It's also worth noting that the body does best when the ratio of omega-6 fatty acids to omega-3 fatty acids in our diets is somewhere in the range of 3:1 to 1:1. This is one of the exceptions to the "more is always better" approach to micronutrients. Achieving this ideal ratio of omega-6 to omega-3 requires a fair bit of attention to food choices. Omega-6s are abundant in grains, legumes, nuts, seeds, processed "vegetable" oils (like safflower oil or canola oil), poultry (even organic!), and industrially produced meat (the kind that isn't labeled "grass-fed" or "pasture-raised"). On the other hand, the extremely important omega-3s DHA and EPA are found in substantial quantities only in grass-fed meat and seafood (mainly fish and shellfish, but also in sea vegetables and algae.) Balancing the intake of these fats requires both lowering the amount of omega-6-rich foods in our diets and conscientiously including more seafood.

THE IDEAL RATIO OF OMEGA-6 FATTY ACIDS TO OMEGA-3 FATTY ACIDS IS IN THE RANGE OF

3:1 TO 1:1

Study after study shows that increasing consumption of DHA and EPA, whether via diet or short-term intervention with fish oil supplements, reduces disease severity and symptoms—for instance, it makes the symptoms of rheumatoid arthritis better—and lowers risk of developing certain diseases, such as cardiovascular disease.

No RDA is established for total fat or individual fatty acids; however, the World Health Organization recommends an omega-6 fatty acid intake of 2.5–9% of total calories and an omega-3 fatty acid intake of 0.5–2% of calories. In addition, the Acceptable Macronutrient Distribution Range (AMDR) for total fat consumption is estimated to be between 20% and 35% of total calories.

Cholesterol

> Even though many people associate cholesterol with heart disease, cholesterol is a nutrient that plays an essential biological role.

It is the precursor of steroid hormones, including vitamin D, and bile acids and is a structural component of cellular membranes that helps to maintain membrane fluidity.

What is often referred to as serum or blood cholesterol, isn't actually cholesterol itself, but rather lipid transport molecules called *lipoproteins*. There are four classes of lipoproteins that circulate in our blood: chylomicrons, very-low-density lipoproteins (VLDL), low-density lipoproteins (LDL), and high-density lipoproteins (HDL), which can transport thousands of lipids in a single lipoprotein particle. The two major lipids that are transported by these lipoproteins are triglycerides and cholesterol. As such, it isn't high cholesterol per se that is associated with cardiovascular disease, but rather high levels of VLDL and LDL (or "bad cholesterol") along with high levels of free triglycerides (triglycerides that aren't transported by a lipoprotein) in the blood. High levels of high-density lipoproteins (HDL, or "good cholesterol") are protective against heart disease.

For most people, dietary cholesterol does not translate to elevated LDL and VLDL, the exception being people with one or two copies of the ApoE4 gene. ApoE4 enhances cholesterol absorption in the intestine relative to either ApoE2 or ApoE3. One study found that adding 750mg of cholesterol per day to participants' daily diets (in the form of egg yolks) caused total blood cholesterol and LDL levels to increase more than twice as much in people with two copies of ApoE4 (ApoE4/4, which affects 1 to 2% of the population) compared to people with other ApoE genotypes. This is why being an ApoE4 carrier increases your risk of cardiovascular disease and Alzheimer's disease. People with this gene tend also to see bigger reductions in LDL and VLDL cholesterol when they moderate fat intake, especially reducing saturated fat.

Important Healthy Fats

The following fats are strongly associated with diverse health benefits.

DHA (DOCOSAHEXAENOIC ACID): An omega-3 fatty acid that is abundant in the brain and retinas and plays a role in maintaining normal brain function, treating mood disorders, and reducing risk of heart disease (or improving outcomes for people who already have it). The richest sources are fatty fish, such as salmon, mackerel, tuna, herring, and sardines.

EPA (EICOSAPENTAENOIC ACID): An omega-3 fatty acid that plays a role in anti-inflammatory processes and the health of cell membranes and may help reduce symptoms of depression. Sources include fatty fish (such as salmon, mackerel, tuna, herring, and sardines), purslane, and algae.

CLA (CONJUGATED LINOLEIC ACIDS): A family of naturally occurring *trans* fatty acids that exhibit strong anticancer effects and may improve bone density and increase muscle mass. CLAs are found in ruminant meat, such as beef, lamb, elk, and goat, as well as dairy from grass-fed animals.

MONOUNSATURATED FATTY ACIDS (MUFA): A type of fat that may help reduce LDL ("bad") cholesterol while potentially increasing HDL ("good") cholesterol and help improve blood sugar control. Foods rich in MUFA include olives, tree nuts like almonds, avocados, and seeds.

MEDIUM CHAIN TRIGLYCERIDES (MCT): A collection of 6 to 12 carbon atom long saturated fatty acids that reduces inflammation, increases activity of the histamine-clearing enzyme diamine oxidase, and improves gut barrier health. The richest food sources are coconut oil and palm oil.

Protein and Amino Acids

> Proteins are the molecules that actually perform most of the various functions of life.

In addition to being major structural components of cells and tissues, they have incredibly diverse roles from driving chemical reactions (e.g., enzymes) to signaling (e.g., some types of hormones) to transporting and storing nutrients.

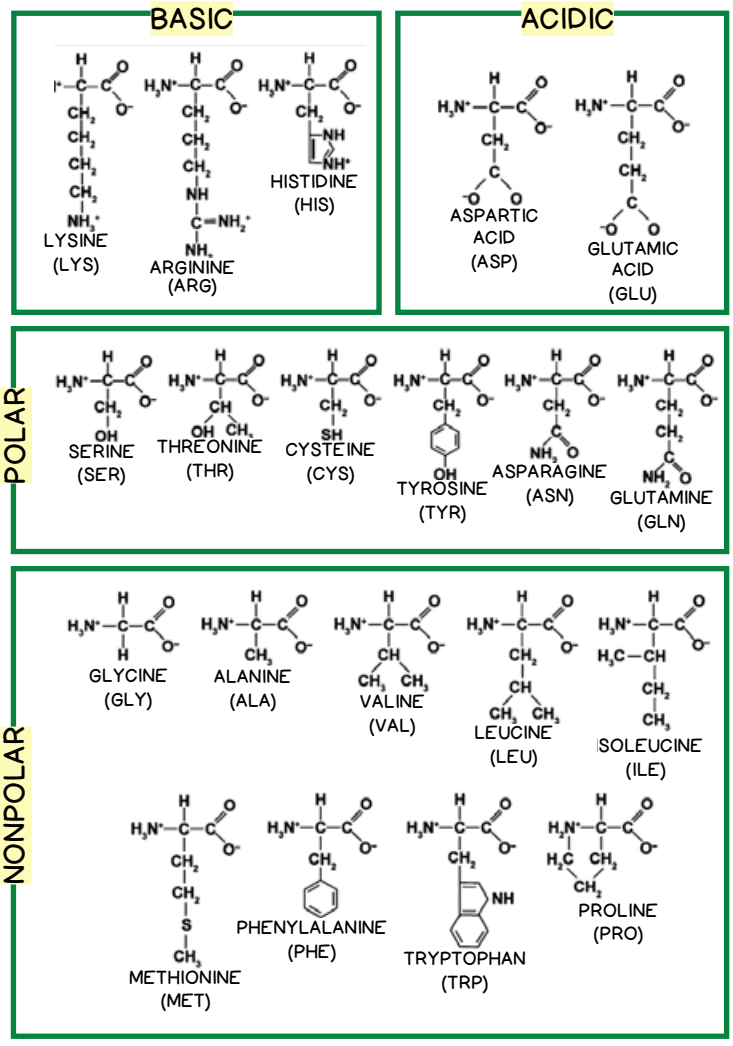
Proteins are made from long chains of amino acids, anywhere from twenty to more than two thousand amino acids long. Amino acids have the general molecular formula of R-CH(NH_2)-COOH. In this molecule, NH_2 is the basic amino group, COOH is an acidic carboxyl group, and R represents a molecular unit called a side chain that is unique for each amino acid. The chemical properties of the side chain create classes of amino acids: nonpolar and aliphatic; aromatic (generally nonpolar); polar but uncharged; negatively charged (acidic); and positively charged (basic).

While approximately five hundred different amino acids have been identified in various life forms, only twenty are used to build every single type of protein in the human body. Two additional amino acids

(selenocysteine and pyrrolysine) can be incorporated into proteins after being built (by a chemical reaction called post-translational modification). As you can imagine, there are many ways to string twenty different amino acids together. This is how twenty simple building blocks form all the proteins in your body, from the components of the cells of your organs to the hormones that circulate in your blood.

In addition, a variety of non-proteinogenic amino acids, that is amino acids that are not encoded into our DNA nor incorporated into proteins, have biological roles in the human body. For example, GABA and glutamate are important neurotransmitters, levodopa is an important neurotransmitter precursor that also mediates neurotropic factor release in the central nervous system, and ornithine is essential for the urea cycle. Non-proteinogenic amino acids can be obtained from food sources or enzymatically produced from other amino acids. For example, ornithine can be produced by the action of the enzyme arginase on the amino acid arginine (a chemical reaction that also produces urea).

Of the twenty amino acids encoded in our genetics and used to build the proteins in our bodies, only nine of those are considered nutritionally indispensable, meaning that we absolutely have to get them from food—our bodies can't make them. These nine essential amino acids are isoleucine, histidine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine. Six additional amino acids are considered conditionally indispensable, meaning that while other amino acids can be converted into these amino acids, the process is so inefficient that most of the time, we still need to get them from food. These six conditionally indispensable amino acids are arginine, cysteine, glycine, glutamine, proline and tyrosine. The remaining five amino acids are considered nutritionally dispensable, meaning that our bodies can make them in sufficient quantities provided that there's enough protein in our diets. These nutritionally dispensable amino acids are alanine, aspartic acid, asparagine, glutamic acid and serine. While technically we need to get only the nine essential amino acids through diet—our bodies can create the remaining eleven—it is far preferable from a health standpoint to get all of the amino acids from foods. That way, we don't have to rely on often inefficient conversion processes for the amino acids our bodies need to make all the various proteins in our cells and tissues.



> Complete proteins provide sufficient quantities of all nine essential amino acids, and for the most part, they come from animals–meat, eggs, seafood, and dairy are all complete proteins.

Most plant foods are not complete proteins, and it's not usually easy for our bodies to fully digest and break down plant proteins in order to absorb their amino acids. In fact, all proteins from animal foods are easier to digest than proteins from plant foods.

A number of methods have been used to assess protein quality, but the newest and most comprehensive one (promoted by the Food and Agriculture Organization) is the Digestible Indispensable Amino Acid Score (DIAAS). This method measures the digestibility of individual amino acids by analyzing fecal matter at the end of the small intestine (in contrast to the previous protein ranking standard, the Protein Digestibility Corrected Amino Acid Score (PDCAAS), which measures absorption throughout the digestive system and doesn't take into account protein absorption by gut bacteria!). The DIAAS score is calculated based on individual amino acid digestibility, the original amino acid content of food, and human amino acid requirements. The higher the score, the higher the protein quality. Here are some measurements of common foods:

- WHOLE MILK : 1.14
- WHOLE EGG: 1.13
- BEEF: 1.10
- CHICKEN BREAST: 1.08
- FISH (PANGAS): 1.06
- FISH (TILAPIA): 1.00
- GARBANZO BEANS: 0.66
- COOKED RICE: 0.59
- COOKED PEAS: 0.58
- LENTILS: 0.54
- ROLLED OATS: 0.54
- TOFU: 0.52
- RED KIDNEY BEANS: 0.51
- BARLEY: 0.51
- BLACK BEANS: 0.49
- RYE: 0.47
- ROASTED PEANUTS: 0.43
- WHEAT: 0.43
- ALMONDS: 0.40

While plant foods are extremely important for health, it's misleading to think of them as a good protein source—even legumes, nuts, and seeds, which technically contain way more protein than fruits and vegetables, are not as rich in protein as animal foods. Animal foods contain all twenty amino acids and are the only sources of some other key nutrients, including vitamin B12, creatine, taurine, and carnosine (these last three are not considered essential, but they are very important and promote health). Therefore, a Nutrivore diet must include fish and shellfish at the very least, if not a wide variety of meats.

Protein deficiency is detrimental to all of the body's organs and systems, including impacting function of the brain (especially in infants and young children), immune system, gut barrier, and kidneys. Physical signs of protein deficiency include edema (swelling), poor musculature, dull skin, thin and fragile hair, and failure to thrive in infants and children.

The Twenty Proteinogenic Amino Acids

ALANINE: A nutritionally dispensable amino acid involved in sugar and acid metabolism. It can potentially increase exercise capacity, help build lean muscle mass, and improve immunity. Foods high in alanine include animal products (fish, meat, poultry, and dairy), legumes, nuts, and seeds.

ARGININE: A conditionally indispensable amino acid that plays a vital role in cell division, wound healing, hormone release, and immune function. Arginine is found in both plant and animal foods, including dairy products, meat, poultry, seafood, nuts, and legumes.

ASPARAGINE: A nutritionally dispensable amino acid involved in cell functions in nerve and brain tissue. It can be synthesized from aspartic acid (see below) but is also found in dietary sources such as plant proteins (legumes, nuts, and seeds), dairy products, beef, poultry, eggs, fish and other seafood, potatoes, and—not surprisingly—asparagus.

ASPARTIC ACID: A nutritionally dispensable amino acid that serves as a neurotransmitter and plays an important role in synthesizing other amino acids (asparagine, arginine, lysine, methionine, and isoleucine). It's also involved in the citric acid and urea cycles in the body and plays a role in gluconeogenesis. Foods high in aspartic acid include oysters, wild game, avocado, asparagus, molasses, and seeds.

CYSTEINE: A conditionally indispensable amino acid that helps form the powerful antioxidant glutathione, as well as supports respiratory health and the removal of metal ions and harmful chemicals from the body. Although the body can produce cysteine from another amino acid, methionine (see below), the pathway can be compromised if intake of vitamin B9 (folate), vitamin B6, and vitamin B12 (along with methionine) is inadequate. Dietary sources of cysteine include meat, poultry, eggs, dairy, red peppers, onions, garlic, Brussels sprouts, sprouted lentils, and broccoli.

GLUTAMINE: A conditionally indispensable amino acid that can help improve intestinal barrier (or gut barrier) function and reduce intestinal permeability (which may be associated with many chronic diseases), treat mood disorders, prevent disease-related weight loss, and reduce infection risk. Rich sources include high-protein animal products (fish, meat, poultry, and dairy), legumes, spinach, beets, and parsley.

GLUTAMIC ACID: A nutritionally dispensable amino acid that serves as the central nervous system's most abundant excitatory neurotransmitter. It's also a key compound in cellular metabolism and imparts a savory "umami" taste to foods. Sources of glutamic acid include seaweed, meat, poultry, fish, dairy products, and eggs.

GLYCINE: A conditionally indispensable amino acid that is used in collagen production and plays a number of other beneficial roles in the body. It may help improve sleep quality, enhance memory, regulate bile acids, and assist in the synthesis of several extremely important proteins. It may also help reverse age-related damage to fibroblasts, a type of cell in connective tissues that produces collagen, and as a result may have antiaging effects. Foods containing glycine include high-protein animal products (fish, meat, poultry, and dairy), spinach, legumes, squash, and cruciferous vegetables.

HISTIDINE: An indispensable amino acid involved in growth, tissue repair, and the manufacture of red blood cells. It helps defend against tissue damage from radiation and heavy metals and plays a role in maintaining the myelin sheaths that protect nerve cells. Histidine is also metabolized into the neurotransmitter histamine, which is involved in immune function, sexual functions, and gastric secretion. Rich dietary sources include high-protein foods like meat, poultry, fish, dairy, beans, and eggs; it is also found in cauliflower, mushrooms, bananas, cantaloupe, rice, bamboo shoots, and citrus fruits.

ISOLEUCINE: An indispensable amino acid that plays an important role in hemoglobin synthesis, blood sugar regulation, and maintenance of energy levels. Foods rich in isoleucine include seaweed, turkey, chicken, fish, lamb, cheese, and eggs.

LEUCINE: An indispensable amino acid used for a number of metabolic functions, including the formation of sterols in fat and muscle tissue, mTOR activation (which regulates cell metabolism, growth, proliferation and survival), and direct stimulation of muscle protein synthesis. Leucine is found in hemp seed, beef, fish, almonds, chicken, eggs, beans, lentils, milk, and rice.

LYSINE: An indispensable amino acid that is required for growth and tissue repair and that appears to be active against herpes simplex viruses (due to its ability to compete with arginine, an amino acid needed by viruses, for entrance into cells). Dietary sources include red meat, pork, poultry, fish (especially cod and sardines), dairy products, eggs, spirulina, and fenugreek seed.

METHIONINE: An indispensable amino acid used for angiogenesis (the growth of new blood vessels), the synthesis of cysteine, and the creation of cartilage. It also helps the body produce S-Adenosyl-L-methionine (SAMe), which may benefit psychiatric illnesses and musculoskeletal conditions. Methionine is found in large quantities in eggs, fish, Brazil nuts, sesame seeds, and muscle meats.

PHENYLALANINE: An indispensable amino acid that supports the structure and function of different proteins and enzymes within the body. It's involved in synthesizing the neurotransmitters dopamine and norepinephrine and can also be converted into the amino acid tyrosine. Phenylalanine is found in most protein-rich foods, including beef, pork, poultry, fish, dairy products, eggs, nuts, and seeds.

PROLINE: A conditionally indispensable amino acid that's used in collagen production and helps maintain healthy skin, joints, tendons, and cardiac muscle. Foods high in proline include dairy products, meat, poultry, eggs, and seafood, as well as vegetables like broccoli and cabbage.

SERINE: A nutritionally dispensable amino acid involved in metabolism, particularly the biosynthesis of purines and pyrimidines. Serine-based molecules are required for the function of many enzymes, fatty acid metabolism, cell membrane structures, muscle growth, and immune function. Rich sources of serine include meat, dairy products, eggs, fish, almonds, asparagus, lentils, pistachios, sesame seeds, cauliflower, fenugreek seed, and beans.

THREONINE: An indispensable amino acid that promotes normal growth, supports cardiovascular health, keeps bones and tooth enamel strong, and is involved in liver, central nervous system, and immune system

function. Threonine is important for connective tissue and muscle strength and elasticity and may also improve wound healing and recovery from injury. It's found in dairy foods, fish, poultry, meat, lentils, sesame seeds, mushrooms, and leafy vegetables.

TRYPTOPHAN: An indispensable amino acid needed for normal growth, nitrogen balance, niacin synthesis, and making the neurotransmitter serotonin. It's found in most high-protein foods, including eggs, fish, dairy products, turkey, chicken, beef, lamb, sunflower seeds, and sesame seeds.

TYROSINE: A conditionally indispensable amino acid used to produce the neurotransmitters epinephrine, norepinephrine, and dopamine. It also supports adrenal, thyroid, and pituitary gland function and the creation and regulation of hormones. Tyrosine is found in chicken, fish, turkey, almonds, bananas, dairy products, lima beans, pumpkin seeds, sesame seeds, and avocados.

VALINE: An indispensable amino acid that works in conjunction with other amino acids (namely isoleucine and leucine) to repair tissues, maintain energy levels, regulate blood sugar, and promote normal growth. Abundant sources of valine include dairy products, nuts, seeds, fish, beans, and mushrooms.

Other Health-Promoting Amino Acids and Peptides

ANSERINE: A dipeptide with antioxidant capacity that can effectively relieve stress and fatigue, ameliorate anxiety, promote post-partum lactation, improve physical capacity and exercise performance, reduce hyperglycemia and hypertension, enhance immunity, prevent aging-associated neurological (e.g., cognitive and memory) dysfunction and inflammation, and accelerate wound healing. Foods highest in anserine include meat, poultry and some fish (salmon, tuna and trout).

CARNOSINE: A dipeptide that helps slow aging in cells, particularly by protecting against oxidation and DNA damage and slowing the rate of advanced glycation end-product (AGE) formation. It appears to protect against the buildup of atherosclerotic plaque. Foods highest in carnosine include meat, poultry and fish.

CREATINE: A non-proteinogenic amino acid that helps supply energy to cells, especially muscle cells. It may help increase muscle strength, boost functional performance, and reduce DNA mutation. Foods high in creatine include animal products like meat, dairy, eggs, poultry, and seafood.

ERGOTHIONEINE: A non-proteinogenic amino acid with powerful antioxidant and anti-inflammatory properties shown to mitigate diseases associated with aging, including cardiovascular disease, cancer, liver disease, cataracts, and Alzheimer's disease. Ergothioneine has even been called the "longevity vitamin" since studies show that it reduces all-cause mortality and is associated with longer lifespan. The main dietary source of ergothioneine is mushrooms—it's particularly high in medicinal mushrooms and some culinary varieties like shiitake, maitake and oyster. For example, oyster mushrooms contain double the ergothioneine per kilogram of button mushrooms. There are minute amounts in some other foods, like tempeh, kidney beans and chicken liver.

4-HYDROXYPROLINE: An antioxidant amino acid that is a key component of collagen, the dominant structural protein and main building block of connective and interstitial tissues, bone, cartilage, ligaments, tendons, and skin, and which is also abundant in muscles, blood vessels, corneas, and teeth. Foods highest in 4-hydroxyproline include collage-rich cuts of meat like offal, skin, joints (trotters, duck feet, chicken wings, etc.) as well as fish and bone broth.

TAURINE: A non-proteinogenic amino sulfonic acid that supports neurological development, serves as a major component of bile, and plays a role in water and mineral regulation within the blood (including through membrane stabilization and calcium signaling). It also plays a role in cardiovascular function and the development of skeletal muscle. Taurine is found most abundantly in seafood, dairy products, eggs, seaweed, and certain meats (including beef, lamb, and dark chicken meat).

Vitamins and Vitaminlike Compounds

> A vitamin is defined as any organic compound that a living organism requires, but which it is not capable of producing itself, or cannot produce in the amounts required by the body.

Rather than being categorized by chemical structure, a vitamin earns its designation based on its biological activity.

The term *vitamin* is derived from the Latin *vita*, meaning "essence of life." Discovered predominantly in the late nineteenth and early twentieth centuries, vitamins were labeled with letters (A, B, C, D, E, etc.) as they were discovered, until technological advances permitting the identification of molecular structures changed the nomenclature. Many of the post-E vitamins were later relabeled as vitamins in the B complex, with designations between B2 and B12. For example, vitamin G was renamed vitamin B2 or riboflavin; vitamin H is now called B7 or biotin; and vitamin M is now called B9 or folate. Other substances originally labeled as vitamins lost their classification once their structure was identified; for example, flavonoids were originally given the name vitamin P. More recently discovered compounds being identified as essential (such as choline, carnitine, inositol, and ubiquinol) may eventually be classified as vitamins but likely will never receive a letter designation.

VITAMINS CAN BE BROADLY DIVIDED INTO TWO CLASSES:

- **FAT-SOLUBLE VITAMINS,** including vitamins A, D, E, and K, dissolve in fats and oils.
- **WATER-SOLUBLE VITAMINS**, including all the B vitamins and vitamin C, dissolve in water.

This property affects the way in which vitamins are absorbed and used in the body. Fat-soluble vitamins tend to form important elements of cell membranes and water-soluble vitamins tend to act as coenzymes (a nonprotein compound that is necessary for the functioning of an enzyme).

Essential Vitamins

Each vitamin plays an important and unique role in supporting human health.

VITAMIN A (RETINOL): Not to be confused with beta-carotene (which is a vitamin A precursor, not vitamin A itself), this vitamin is essential for bone growth, tooth remineralization, skin health, vision, reproduction, and immune function. Retinol is found only in animal foods, including liver, eggs, quality dairy products, and seafood (especially shrimp, salmon, sardines, and tuna).

VITAMIN B1 (THIAMIN): Important for energy metabolism, cellular function, and a wide variety of organ functions. Sources include organ meat, pork, seeds, squash, fish (especially trout, mackerel, salmon, and tuna), and legumes.

VITAMIN B2 (RIBOFLAVIN): Aids in the production of two other B vitamins (B3 and B6) and plays an important role in energy metabolism. Riboflavin also acts as an antioxidant. Rich sources include organ meat, mushrooms, leafy green vegetables, eggs, legumes, and squash.

VITAMIN B3 (NIACIN): Helps improve circulation, aids the body in manufacturing stress- and sex-related hormones, and suppresses inflammation. Excellent sources include organ meat, poultry, fish and shellfish, red meat (including beef and lamb), mushrooms, and leafy green vegetables.

VITAMIN B5 (PANTOTHENIC ACID): Along with assisting in energy metabolism (like all B vitamins), vitamin B5 plays a role in manufacturing red blood cells, sex hormones, and stress hormones. It also helps maintain a healthy digestive tract and enables the body to use vitamin B2. Sources include organ meat, mushrooms, oily fish, avocados, red meat (especially beef and lamb), and seeds.

VITAMIN B6 (PYRIDOXINE): Important for cell metabolism and the production of hemoglobin, which carries oxygen in the blood. B6 is also vital for producing the key neurotransmitters GABA, dopamine, and serotonin. Sources include a wide variety of plant and animal foods, including leafy and root vegetables, fruits such as bananas, red meat, poultry, and seeds (especially sunflower and pumpkin seeds).

VITAMIN B7 (BIOTIN): Involved in many metabolic pathways, especially fat and sugar metabolism. It also helps maintain skin and hair health. Foods high in biotin include eggs, liver, nuts such as almonds and walnuts, root vegetables, and tomatoes.

VITAMIN B9 (FOLATE): Plays an important role in methylation (the process of adding a methyl group to different molecules), making it a key player in methylation-dependent processes like detoxification and neuron signaling. Folate is also crucial for cardiovascular health, reproductive function (especially protecting against neural tube defects), and red blood cell production. Rich sources include organ meat, green vegetables (both leafy and non-leafy), legumes, beets, avocados, and fruits such as papayas, strawberries, and pomegranates.

VITAMIN B12 (COBALAMIN): Involved in energy metabolism like the other B vitamins, but also plays a unique role in DNA production. It's vital for maintaining cardiovascular, brain, and nervous system health. Because vitamin B12 is manufactured exclusively by microorganisms, it's found mostly in animal foods that concentrate bacterially produced B12 in their cells, such as fish (especially sardines, salmon, tuna, and cod), shellfish such as shrimp and scallops, organ meat, beef, poultry, and eggs. Some fermented soy products like tempeh also contain vitamin B12.

VITAMIN C: A potent antioxidant that's necessary for immune system function and the function of several enzymes (like some that help make collagen, which is why vitamin C deficiency causes scurvy). Foods rich in vitamin C include bell peppers, leafy dark green vegetables, citrus fruits, and other fruits such as papaya, cantaloupe, guava, and berries. Some organ meats are also good sources of vitamin C.

VITAMIN D: Assists in calcium absorption, immune system function, bone development, modulation of cell growth, neuromuscular function, and the reduction of inflammation. Although vitamin D can be produced when the sun's UV rays hit the skin and trigger vitamin D synthesis, it also can be obtained from foods, including oily fish (such as salmon, tuna, and mackerel), mushrooms, fish roe, liver, and eggs.

VITAMIN E: Actually a group of eight fat-soluble antioxidants, the most well-known of which is α-tocopherol. All forms of vitamin E help protect against free radical damage, reduce the harmful oxidation of LDL ("bad") cholesterol particles in the bloodstream, and boost cardiovascular health. Foods high in vitamin E include nuts, seeds, leafy green vegetables, fatty fish, organ meat, and oily plant foods like avocados and olives.

VITAMIN K: Central to maintaining bone health and critical for making important proteins that are involved in blood clotting and metabolism (in fact, the K comes from the German word for blood clotting, koagulation). Vitamin K exists in the forms K1, K2, and K3; the K2 form boosts cardiovascular health. The richest sources of vitamin K include cruciferous vegetables (such as broccoli, cauliflower, cabbage, and Brussels sprouts) and leafy dark green vegetables (such as spinach, collard greens, parsley, and Swiss chard), as well as asparagus. Vitamin K2 is found in natto (a fermented soybean product), eggs, butter, and liver.

Vitaminlike Compounds

There are many vitaminlike compounds that are also essential to support health.

ALPHA-LIPOIC ACID (α-LIPOIC ACID): A vitaminlike organosulfur compound with antioxidant effects, α-lipoic acid is a cofactor for several important mitochondrial multienzyme complexes. It improves insulin sensitivity, nerve function and cardiovascular health and decreases inflammation. Organ meats are the best source, but other good sources include red meat, broccoli, tomatoes, spinach, Brussels sprouts, and potatoes.

BETAINE: A vitaminlike derivative of choline, betaine is both an osmolyte (protecting cells and proteins from environmental stressors) and a methyl donor (participating in the methionine cycle primarily in the liver and kidneys0. Betaine helps to metabolize homocysteine, high levels of which are associated with heart disease, stroke and osteoporosis. Foods rich in betaine include seafood, especially shellfish, spinach and beets.

CARNITINE: An ammonia based compound, carnitine transports long-chain fatty acids into mitochondria to be oxidized for energy production, while also helping to remove metabolic waste products out of the mitochondria. It has been shown to improve insulin sensitivity and improve cardiovascular health. Carnitine is especially rich in red meat but is also found in poultry, fish, and dairy products.

CHOLINE: Plays an essential role in building cell membranes. It also serves as the backbone for a neurotransmitter called acetylcholine, which is involved in heart health, gut motility (the movement of contents through the digestive tract controlled by the coordinated contraction and relaxation of specialized gut muscle tissue), and muscle movement. Choline is abundant in foods such as fish and shellfish, liver, eggs, poultry, and green vegetables (both leafy and non-leafy).

COQ10 (UBIQUINONE AND UBIQUINOL): Ubiquinone is the oxidized form and ubiquinol is the reduced, more bioavailable form of the vitaminlike compound coenzyme Q10 (coQ10). CoQ10 is a potent antioxidant and a cofactor in the electron transport chain for the production of ATP. It may be helpful in treating or preventing heart and blood vessel conditions, diabetes, gum disease, muscular dystrophy, chronic fatigue syndrome, and breast cancer. Sources include beef, pork, mackerel, yellowtail fish, and chicken; it's also found in smaller amounts in vegetables like broccoli and herbs like parsley.

INOSITOL (A.K.A. MYO-INOSITOL): Sometimes referred to as vitamin B8, inositol is a carbocyclic sugar that is an important structural component of cell membranes. It mediates cell signal transduction in response to a variety of hormones (including insulin), neurotransmitters, and growth factors and participates in osmoregulation. It has been shown to improve insulin sensitivity and reduce anxiety. Foods rich in inositol include fruits, legumes, and nuts.

PYRROLOQUINOLINE QUINONE (PQQ): A vitaminlike compound, PQQ supports mitochondrial function and has potent antioxidant effects. It has been shown to have neuroprotective and nootropic effects, enhancing memory and cognition, as well as anti-inflammatory benefits. Food sources include tea, dark chocolate, spinach, kiwi, and soybeans.

Minerals

> A mineral is a chemical element (that is, a member of the Periodic Table of Elements) required as an essential nutrient other than carbon, hydrogen, nitrogen, oxygen, and sulfur (which form the backbone of most organic molecules including amino acids, fatty acids, and vitamins).

Dietary minerals may be present in inorganic salts (like table salt, a.k.a. sodium chloride) or as part of carbon-containing organic compounds (like magnesium in chlorophyll, the pigment that makes plants green).

DIETARY MINERALS:

- INORGANIC SALTS
  (like table salt, a.k.a. sodium chloride)
- PART OF CARBON-CONTAINING ORGANIC COMPOUNDS
  (like magnesium in chlorophyll)

Essential minerals can be divided into *macrominerals*, which we need in excess of 100 milligrams per day to avoid symptoms of deficiency, and *trace minerals*, which we need in much smaller amounts (1 to 100 milligrams per day). *Macrominerals* include sodium, chloride, potassium, phosphorus, magnesium, sulfur, and calcium. Trace minerals include copper, chromium, fluoride, iodine, iron, molybdenum, manganese, selenium, and zinc.

Essential Minerals

BORON: Supports bone health and is essential for the utilization of vitamin D and calcium in the body. Sources include nuts, avocados, leafy green vegetables, legumes, and a variety of other vegetables and fruits, such as apples, carrots, broccoli, pears, and olives.

CALCIUM: In addition to forming bone, calcium is essential to many processes within cells as well as neurotransmitter release and muscle contraction (including the beating of your heart!). Foods rich in calcium include dark green vegetables, sesame seeds, dairy products, whole sardines (bones included), and squash.

CHLORINE: Required for the production of hydrochloric acid in the stomach and important for electrolyte balance and fluid balance in the body. Foods high in chlorine include seaweed, tomatoes, olives, celery, and lettuce, although most foods contain at least small amounts.

CHROMIUM: Important for sugar and fat metabolism and particularly critical for blood sugar control. Chromium is found in small amounts in every food group but is most abundant in foods such as oysters, liver, broccoli, green beans, leafy green vegetables, mushrooms, and tomatoes.

COPPER: Required for many proteins and enzymes. Involved in the absorption, storage, and metabolism of iron and the formation of red blood cells. Copper is also important for building strong tissue and producing cellular energy. Sources include oysters and other shellfish, legumes, nuts, organ meat, and mushrooms.

IODINE: A constituent of thyroid hormones, iodine has diverse roles in the body. It is important for lactation and plays a part in supporting the immune system. Sources include sea vegetables (especially brown varieties such as kelp and wakame), fish, shellfish, eggs, and dairy products.

IRON: A key component of hemoglobin, the protein in the blood that binds to oxygen and transports it throughout the body. Iron is also important for supporting energy production and proper metabolism in muscles and active organs. You can find iron in foods such as liver, leafy dark green vegetables, red meat, legumes, and olives.

MAGNESIUM: Necessary for cell life. More than 300 different enzymes need magnesium to work, including every enzyme that uses or synthesizes ATP (the basic energy molecule in a cell) and enzymes that synthesize DNA and RNA. Magnesium also enhances control of inflammation and maintains nervous system balance. Foods rich in magnesium include green vegetables, nuts and seeds, fish, legumes, and avocados.

MANGANESE: Necessary for enzymes that protect the body from and repair damage caused by free radicals. This mineral is important for bone production, skin integrity, and blood sugar control. Foods high in manganese include fish and shellfish, nuts and seeds, legumes, leafy dark green vegetables, and cruciferous vegetables (such as broccoli, cauliflower, cabbage, kale, Brussels sprouts, and turnip greens).

MOLYBDENUM: Necessary for activity of key enzymes that perform detoxification functions in the liver. It also plays an important role in nervous system metabolism. Molybdenum is found in legumes, eggs, tomatoes, lettuce, and a variety of other vegetables, including celery, fennel, and cucumbers.

PHOSPHORUS: Plays a role in every metabolic reaction in the body and is important for the metabolism of fats, carbohydrates, and proteins. It also serves a central function in bone support. Phosphorous is abundant in protein-rich foods such as dairy products, fish, shellfish, seeds, and legumes.

POTASSIUM: Critical for the function of every cell; it is necessary for nerve function, cardiac function, and muscle contraction. As an electrolyte, it helps conduct electrical charges in the body. Rich sources include leafy dark green vegetables, cruciferous vegetables, some fruits (such as bananas and cantaloupe), legumes, and many orange vegetables (such as carrots, squash, and sweet potatoes).

SODIUM: Necessary for electrolyte balance; for regulating blood pressure, volume, and pH; for controlling the movement of fluids across cell membranes; and for neuron function. Along with any food doused in table salt or cured in salt, such as olives and some meats, natural sources of sodium include seaweed, celery, turnips, artichokes, and some leafy green vegetables, such as spinach and collard greens. Too much sodium isn't a good thing; it's preferable to get your sodium from whole-food sources and conservative use of unrefined sea salt.

SELENIUM: Required for the activity of twenty-five to thirty different enzymes that protect the brain and other tissues from oxidative damage. Selenium also helps support normal thyroid function. Good sources include red meat, poultry, fish and shellfish, Brazil nuts, and mushrooms.

SILICON: Required for the formation of connective tissues and bone. It also supports the health of hair, nails, and skin. Sources of silicon include bananas, string beans, legumes, apples, and cabbage.

SULFUR: Widely used in biochemical processes, sulfur is a structural component of many proteins and is necessary for the function of many enzymes and antioxidants. It is abundant in cruciferous vegetables, alliums such as onions and garlic, eggs, and other protein-rich animal foods, such as fish, meat, and poultry.

ZINC: Important for nearly every cellular function, from protein and carbohydrate metabolism to cell division and growth. Zinc also plays a role in skin health and the maintenance of sensory organs (that's why zinc deficiency is associated with a loss of smell and taste) and is a vital nutrient for immune system function. Zinc also plays a vital role in epithelial barrier function by improving tight junction formation. The richest source is oysters, but other good sources include red meat, poultry, nuts and seeds, and legumes.

OTHER TRACE MINERALS: We seem to have a biological need for dozens of other minerals, albeit in very small quantities, making them ultra-trace minerals. Vanadium, bromine, titanium, nickel, tin, lithium, aluminum, bismuth, and even gold all have probable essential biological roles, although more research is needed. Good food sources of trace minerals include sea vegetables and unrefined sea salt like Himalayan pink salt.

Phytonutrients

Phytonutrients are amazing gifts from the plant kingdom. Phytonutrients are biologically-active, nutritive compounds in plants (derived from the Greek phyton meaning "plant"), where they serve a variety of functions, such as supporting plant growth and reproduction, or providing defense against pathogens, predators or competitors. Even though the human body cannot synthesize phytonutrients, they are not classified as essential nutrients, a fact that reflects more closely our limited knowledge of exactly how these 25,000-plus compounds benefit human health rather than their nutritional importance. Certain phytonutrients have the ability to slow the growth of cancer cells, help regulate hormones, prevent DNA damage, protect against oxidative stress, reduce inflammation, and induce apoptosis (death)

A RAINBOW OF NUTRIENTS

in damaged cells (like a spring cleanup)—just to name a few of their beneficial activities. No wonder studies show that the higher our consumption of these beneficial compounds, the lower our risk of chronic disease.

A few classes of phytonutrients are the subject of intense study for their promising roles in supporting human health. These include carotenoids, chlorophyll, sterols and stanols, glucosinolates, thiosulfinates, triterpenes, and polyphenols.

Science has only scratched the surface of the 25,000+ phytonutrients in existence, but we know enough so far to say that many of these compounds are true rock stars! We have mounting research that a few classes of phytonutrients in particular play such a major role in human health that their dietary abundance is a necessary feature of any food plan designed to promote health.

Phenolic Compounds

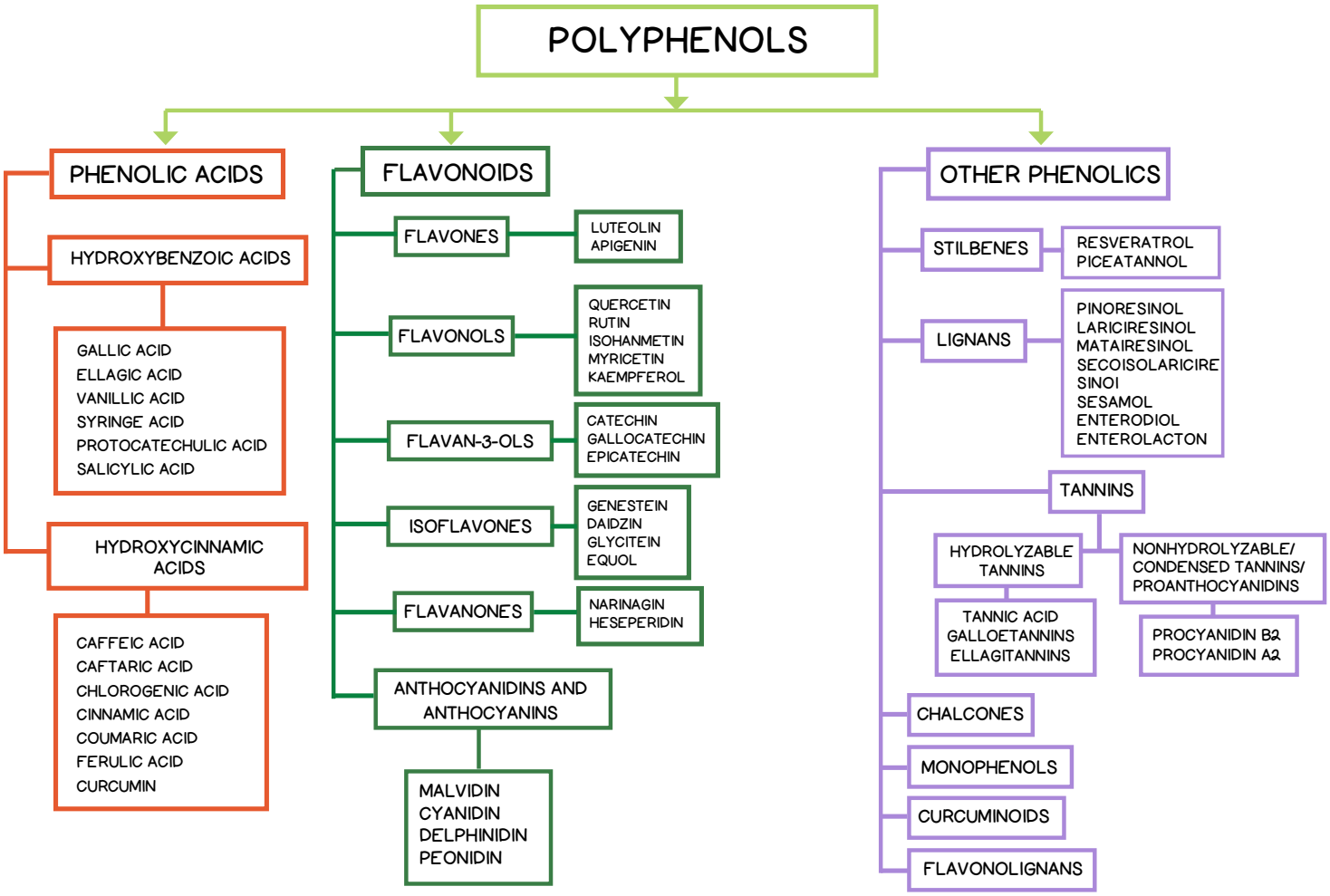
Phenolic compounds are an incredibly broad class of organic molecules characterized by the presence of one or more phenolic units, that is, one or more hydroxyl groups (—OH) bonded directly to an aromatic hydrocarbon group. The simplest phenolic is phenol (also called carbolic acid; C_6H_5OH), which was discovered in 1834 by Friedlieb Ferdinand Runge who extracted it from coal tar.

Polyphenols

Polyphenols are the best-studied class of phytonutrients in terms of their health impact, likely because our intake of polyphenols is higher than any other type of phytonutrient or vitamin antioxidant. They include over 8,000 different compounds. Polyphenols can further be divided into subclasses based on chemical structure, including flavonoids, phenolic acids, flavonolignans, lignans, stilbenoids, tannins, chalcones, and curcuminoids. Phenolic acids (which are sometimes categorized as polyphenols and sometimes and other phenolic compounds) can be further subdivided, again based on chemical structure, into hydroxycinnamic acids and hydroxybenzoic acids. Tannins can be further subdivide into ellagitannins, gallotannins and phlorotannins. Flavonoids (over 4,000 of which have been identified) can also be further subdivided into flavanols, flavonols, flavones, flavanones, flavanonols, isoflavonoids and anthocyanins/anthocyanidins. Flavanols are yet further subdivided into catechins/epicatechins, and proanthocyanidins. And isoflavonoids can be further subdivided into isoflavones, isoflavanes, pterocarpans, and rotenoids. Yes, it's a lot to keep track of!

POLYPHENOLS:

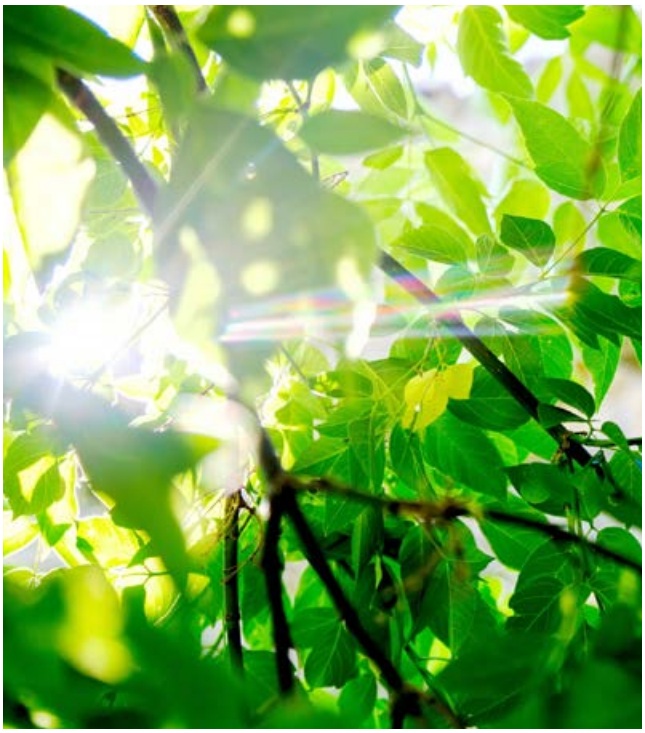
- OUR INTAKE OF POLYPHENOLS IS HIGHER THAN ANY OTHER TYPE OF PHYTONUTRIENT OR VITAMIN ANTIOXIDANT
- OVER 8,000 DIFFERENT COMPOUNDS



For the plants that contain them, polyphenols help protect against sunlight damage (from ultraviolet radiation), deter herbivores, prevent microbial infections, and provide pigmentation (color). And for us humans, polyphenols play a number of important roles as well. Even though polyphenols aren't considered essential nutrients, numerous lines of evidence—from epidemiological studies, human trials, animal models, and mechanistic studies—suggest that polyphenols play a huge role in protecting against cancer, heart disease, diabetes, asthma, osteoporosis, neurodegenerative diseases, and other conditions associated with oxidative stress. In fact, a major reason foods like red wine and olive oil (as well as diets rich in both, such as the Mediterranean diet) show up as so beneficial may be due to their high polyphenol content! Along with chronic diseases, supplementing with polyphenols has been shown to protect against infections and reduce the signs of aging.

Polyphenols exert their most potent effects by acting as antioxidants—preventing cellular damage by neutralizing hazardous oxygen radicals and improving cellular health as a result (which, in turn, benefits virtually every system in the body). As a result of their antioxidant properties, polyphenols also boost the immune system and protect against both chronic and acute diseases. In addition, polyphenols can help regulate enzyme function, stimulate cell receptors, modulate the functions of inflammatory cells (including

T and B lymphocytes, macrophages, platelets, and natural killer cells), alter adhesion molecule expression, affect nerve cells and cardiac muscle cells, and exert antiviral effects.



In fact, a recent study showed that overall mortality was reduced by 30% in participants who ate a diet rich in polyphenols (greater than 650 milligrams/day) as compared with participants who had low polyphenol intakes (less than 500 milligrams/day). For reference, fruits and vegetables typically contain 200 to 300 milligrams per 100-gram serving. In fact, apples are the main source of polyphenols in the American diet.

Because this class of compounds is so diverse, scientists sometimes divide polyphenols in to two sub-categories: flavonoids and non-flavonoids (which both encompass even more sub-categories).

FLAVONOIDS

Flavonoids (also called bioflavonoids) are a diverse group of polyphenols (including more than 6,000 plant metabolites!) that may help reduce inflammation, exert antibacterial properties, and protect against heart disease and certain cancers. Although flavonoids have a range of different health effects, their benefits seem to be primarily due to helping regulate cell-signaling pathways (rather than by acting as antioxidants, which is a perk many phytonutrients offer). Flavonoids can be classified into seven major classes: flavones, flavanones, flavonols, flavanonols, isoflavones, flavanols (also called flavan-3-ols) and anthocyanidins/anthocyanins.

- FLAVONES are a class of flavonoids with anticancer and anti-inflammatory properties. They include apigenin, luteolin, chrysin, and baicalein, and are most abundantly found in spices and red or purple fruits and vegetables—particular parsley, thyme, and celery. APIGENIN (very high in all parts of the celery plant—including seeds and heart, along with parsley, oregano, vine spinach, and chamomile) has antimicrobial activity against a number of potential pathogens. CHRYSIN (found in propolis and honey, as well as carrots, chamomile, and mushrooms) has been shown to interfere with the effects of dietary fructose at the intestinal level, along with reducing intestinal inflammation. And BAICALEIN, found in the roots of a Chinese herb called *Scutellaria baicalensis*, has been shown to powerfully inhibit biofilm formation in *Candida albicans*, while also enhancing gut barrier function and supporting a healthy, diverse gut microbiome.

- FLAVANONES are a type of phytonutrient found abundantly in citrus fruit (and to a lesser degree, tomatoes and some herbs such as mint), and most notably include HESPERIDIN (the main flavanone in sweet oranges), NARINGIN (which gives grapefruit its bitter taste), and MORIN (found abundantly in strawberries). Although more research in humans is needed, studies suggest flavanones in general are powerfully cardioprotective and may also reduce risk of diseases, such as cancer. These compounds have been shown to reduce inflammation, reduce hypertension, lower blood lipids, increase insulin sensitivity, and exert antioxidant properties. In the gut, flavanones interact with and influence the microbiota, and these interactions may be responsible for many of the biological effects of flavanones.
- FLAVONOLS can offer major disease protection by potentially increasing plasma antioxidant capacity, decreasing lymphocyte (a type of white blood cell) DNA damage, increasing activity of an antioxidant enzyme called *erythrocyte superoxide dismutase*, and decreasing urinary markers of oxidative damage. Flavonols include the cancer- and the anticancer and cardioprotective phytonutrients KAEMPFEROL (which can interrupt the growth of a variety of cancers, reduce cardiovascular disease mortality, and protect against diabetes), MYRICETIN (which can protect cells from carcinogenic mutations and protect neurons from oxidative stress while also inhibiting the activity of some viruses), and QUERCETIN (which may suppress inflammation in the brain and promote a healthy gut barrier). Rich sources of flavonols include onions, apples, chives, tomatoes, broccoli, cherries, kale, leeks, and pears.
- FLAVONONOLS are another subgroup of flavonoids and includes GENISTEIN, TAXIFOLIN, ENGELETIN, and ASTILBIN. All of these compounds are metabolized by the gut microbiota, although more research is needed to discern the connection between the impact of flavononols on the gut and their subsequent host benefits (including their anti-inflammatory properties and their ability to modulate fat and carbohydrate metabolism). The richest sources are grapes and wine, but flavononols can also be found in macadamia nuts, nectarine, onions, prickly pear, tamarind, sorrel and anise.
- ISOFLAVONOIDS (including isovlavones, isoflavanes, pterocarpans, and retenoids) and their derivatives are considered phytoestrogens, due to the fact that many of these compounds exert biological effects via estrogen receptors (as well as other biological activities that inhibit the synthesis of enzymes involved in estrogen metabolism). The isoflavones DAIDZEIN, GENISTEIN, GLYCITEIN, FORMONONETIN, and DAIDZIN are metabolized by the gut microbiota (particularly *Clostridium* and *Eubacterium*), and the subsequent metabolites appear responsible for the beneficial effects of soybeans found in some studies. Most isoflavonoids are found in the *Fabaceae* family, which includes legumes such as soy.
- ANTHOCYANIDINS and ANTHOCYANINS appear to have anti-inflammatory, antidiabetic, anticancer, cardioprotective and neuroprotective effects and may even have pain-relieving properties due to an affinity for certain "pain-sensation" cell membrane receptors in the brain. Highly related, anthocyanins

are glycosides whereas anthocyanidins are aglycones. These flavonoids give many fruits and vegetables a beautiful blue, purple, or deep red color (think: grapes, red cabbage, cherries, eggplant, blueberries, cranberries, raspberries, and blackberries!).

- FLAVANOLS, also called flavan-3-ols, and not to be confused with flavonols (with two o's!) occur in two forms: catechins and proanthocyanidins (also known as condensed tannins). CATECHINS are found in many types of fruit (apricots are the richest source) as well as red wine and green tea, and PROANTHOCYANIDINS give certain foods and beverages their astringency—including wine, tea, grapes, peaches, berries, pears, and bitter chocolate. Flavanols play an important role in vascular health by supporting normal blood flow and maintaining the elasticity of blood vessels, and they may also have antimicrobial, anticancer, and neuroprotective properties.

NON-FLAVONOIDS

In addition to flavonoids, non-flavonoid polyphenols play some important roles:

- TANNINS are astringent phytonutrients sometimes considered "antinutrients" due to their ability to bind protein and iron. But they actually offer a host of benefits for human health by serving as antioxidants, reducing blood pressure, improving blood lipids, and offering antimicrobial activity. Some tannins can benefit dental health by combating harmful oral bacteria and inhibiting plaque formation. Wine and tea are some of the best-known sources of tannins, but other items include pomegranates, berries, nuts, persimmons, legumes, and certain herbs and spices (cloves, cumin, vanilla, cinnamon, tarragon, and thyme).
- STILBENES aren't found in very high quantities in most foods, but one particular stilbene—resveratrol—had repeatedly shown up in the scientific literature as having strong anticancer properties. Along with its antioxidant effects, resveratrol can thwart all three stages of cancer development (initiation, promotion, and progression) by modulating the pathways involved in cell division, cell growth, cell death, inflammation, angiogenesis (the development of new blood vessels), and metastasis (the spread of tumors). RESVERATROL is a major reason why red wine (and the grapes it's made from) is strongly disease protective: the richest source is grape skins! Other stilbenes, like RHAPONTIGENIN, PINOSYLVIN, and PTEROSTILBENE (an analog of resveratrol and the main antioxidant in blueberries), are also being explored for their potential to protect against (or fight existing) cancer, neurological diseases, inflammation, diabetes, heart disease, and stroke. In fact, pterostilbene is emerging as a possible therapy for Alzheimer's disease!
- COUMARINS are a family of polyphenol benzopyrene chemicals with anti-inflammatory, antioxidant, anticoagulant, antithrombotic, vasodilatory, antimicrobial (antiviral, antifungal, and antiparasitic), anticancer, antidiabetic, analgesic, and neuroprotective properties. At least 1300 different coumarins have been identified, many with strong pharmacological activity, in conjunction with low toxicity and

few side effects, that make them excellent drug candidates. In fact, the blood thinners warfarin and coumadin are both coumarin compounds, as is the antibiotic Novobiocin and the anti-aggressive drug Batoprazine. The high coumarin content of Cassia cinnamon is why it can be toxic in large quantities, causing blood clotting problems that can result in bruising and nose bleeds, in addition to hepatotoxicity.

- LIGNANS are found abundantly in flax seeds and sesame seeds and in smaller amounts in broccoli, kale, apricots, cabbage, and Brussels sprouts. After we eat lignan precursors, our intestinal bacteria convert them into enterolignans called ENTERODIOL and ENTEROLACTONE, which have a steroid structure and can mimic some behaviors of estrogens, categorizing them as phytoestrogens. Although more research is needed, enterolignans have the potential to protect against hormone-associated cancers (breast cancer, ovarian cancer, prostate cancer, and uterine cancer) by blocking the action of true estrogens. Other studies suggest a role for lignans in reducing inflammation, improving glycemic control, combatting viruses, and protecting against heart disease, but we need more research and better-controlled human trials to clarify whether lignans are responsible versus other components of plant foods. Lignans are related to the fiber class lignin, both being polyphenolics derived from lignols, but while lignans tend have a low molecular weight (often dimers), lignins are highly polymerized hence, their behavior as a plant fiber.
- FLAVONOLIGNANS are composed of a phenylpropane unit (coniferyl alcohol) and a flavonoid unit (taxifolin), and have demonstrated a number of health properties. For example, they help modulate various cell-signaling properties, inhibit arachidonic acid metabolism (resulting in lower formation of pro-inflammatory mediators), and even inhibit platelet aggregation, making them potentially helpful for cardiovascular disease. A number of flavonolignans have been isolated from the milk thistle plant, most notably SILYBIN, but also SILYCHRISTIN and SILYDIANIN.
- CHALCONES give a yellow or orange color to foods and have a range of important biological activities that could benefit our health. For example, they've demonstrated antioxidant, antimicrobial, anticancer, anti-inflammatory, and immunosuppressive effects in a range of studies. These phytonutrients may be particularly valuable in fighting cancer, as they've been shown to interfere with all stages of carcinogenesis (initiation, promotion, progression, angiogenesis, invasion, and metastasis), as well as helping regulate cell cycle progressions to favor apoptosis of transformed cells. *In vitro*, different chalcones have exhibited cytotoxic effects against different cancer cells, making them particularly useful in developing anti-cancer drugs. Chalcones also have antimicrobial activity, including against methicillin-resistant *Staphylococcus aureus* (MRSA). Found in citrus fruits, apples, tomatoes, shallots, bean sprouts, potatoes, fingerroot, and licorice.
- CURCUMINOIDS are natural compounds found in turmeric, primarily consisting of CURCUMIN, DEMETHOXYCURCUMIN, and BISDEMETHOXYCURCUMIN. Although all three have demonstrated

health-protective effects, some studies show synergistic activity that makes these curcuminoids more active when combined than when taken individually, especially when it comes to reducing cancer cell viability.

Non-Polyphenols

While polyphenols are the best studied phenolic compounds, there are some other important subclasses of phenolic compounds!

NATURAL MONOPHENOLS

Natural monophenols, also called simple phenols, are characterized by the presence of a single phenol group. They act as radical scavengers, interacting with electron transfer and reactive oxygen species to reduce oxidative stress. Many also have pharmacological action as analgesics, and this phenolic compound class includes salicylic acid (the basis for Aspirin), cannabinoids (including tetrahydrocannabinol [THC] and cannabidiol [CBD]) from cannabis, morphine and heroin. Vitamin E (tocopherol) is also a monophenol. Natural monophenols found in edible plants are a major contributor to their health benefits.

Among some of the best studied natural monophenols is CARNOSOL. It has been shown to have neuro-protective effects, may help protect against brain injury and metabolic syndrome, and improve symptoms of colitis in mouse models. It also has protective effects against prostate cancer, skin cancer, breast cancer, leukemia, and colon cancer—specifically by targeting pathways related to inflammation and cancer cell survival. Experiments have also shown that carnosol is selectively toxic against cancer cells, but not healthy cells. This phytonutrient may also modify the gut microbiota, with animal studies showing it enhances levels of probiotic species while decreasing the growth of pathogens. Interestingly, cornosol may also exert antidepressant effects through its microbiota-modulating properties, with some animal research showing it attenuates depressive-like behaviors, inflammatory reactions in the hippocampus, and gut dysbiosis when given as a pretreatment to chronic restraint mice. Found in rosemary and sage.

Another example of a natural monophenol is APIOLE, which was first discovered in 1715. *In vitro*, it has been shown to have anti-proliferative effects on colon cancer cells and enhance the effects of chemotherapy drugs. Although little research exists on its impact on the gut microbiota, it has some antifungal properties. Found in all parts of the parsley plant and in celery.

CARVACROL has notable antioxidant and anticancer properties; *in vitro* studies show it acts against breast cancer, liver cancer, and lung cancer cells via acting on proapoptotic processes. For example, it can inhibit cell proliferation, reduce cell survival, reduce cell migration and invasion, and significantly increase apoptosis of cancer cells via inhibiting several signaling molecules. It also has extremely high antimicrobial activity against some bacterial pathogens, including *Salmonella*, *E. coli,* and *Bacillus cereus*, as well as fighting the fungi *Candida*. In particular, it's able to inhibit biofilm formation and virulence of pathogens like *E. coli*. Found in oregano, thyme, pepperwort, and bergamot.

DILLAPIOLE, which is found in dill weed and fennel, possesses anti-inflammatory and pain-relieving properties, in addition to fighting some pathogenic microbes, including *Francisella tularensis* and a number of fungal species. And rosemarinol, which is found in rosemary, has antioxidant properties, and also has significant antimicrobial activity against drug-resistant *Mycobacterium smegmatis, Candida albicans,* and *E. coli*.

PHENOLIC ACIDS

Phenolic acids are powerful antioxidants that can be divided into two categories: derivatives of cinnamic acid (called hydroxycinnamic acids) and derivatives of benzoic acid (called hydroxybenzoic acids). The highest sources of phenolic acids are tea (rich in gallic acid), coffee (rich in caffeic acid), and some fruits (including blueberries, kiwis, cherries, plums, and apples).

Derivatives of benzoic acid appear to have strong antimicrobial properties, with particular efficacy against known pathogens, including *Cryptococcus neoformans, Alternaria strains, Escherichia coli, Listeria monocytogenes, Salmonella enteritidis, Listeria innocua, Pseudomonas aeruginosa, Staphylococcus aureus,* and *Clostridium difficile.* Hydroxybenzoic acids include GALLIC ACID (found in black currants, grapes, persimmons, pomegranate, berries, mangoes, rhubarb, soy, olive oil, and tea), VANILLIC ACID (found in açai, vanilla beans, cloves, and dong qua) and SYRINGIC ACID (found in olives, dates, spices, pumpkin, grapes, açai, honey, and red wine).

Hydroxycinnamic acids account for about a third of the total phenolic compounds we consume through food. They have antioxidant, anticollagenase, anti-inflammatory, antityrosinase, and antimicrobial activity, and may also help protect against ultraviolet radiation damage (making them potentially useful as anti-aging agents). Some studies suggest that cinnamic acid derivatives can protect against heart disease by enhancing cholesterol efflux from macrophages (the key way our bodies protect against atherosclerosis, driven by HDL, where macrophages gobble up cholesterol deposits in blood vessels and return them to the liver for excretion in bile). Hydroxycinnamic acids include CAFFEIC ACID (found in coffee, tea, propolis, wine, burdock, pear, sweet potato, artichoke, hawthorn, basil, thyme, oregano, olive oil, and apple), CHLOROGENIC ACID (found in strawberries, pineapple, echinacea, sunflower, blueberries, and coffee), CINNAMIC ACID (found in cinnamon, citrus fruits, grapes, tea, cocoa, spinach, celery, cruciferous vegetables, and aloe), and FERULIC ACID (found in oats, wheat bran, rice, artichokes, pineapple, peanuts, apple, açai, and orange).

PHENYLETHANOIDS

Phenylethanoids are a type of phenolic compound characterized by a phenethyl alcohol structure and are abundant in olives and olive oil.

The olive phenylethanoid HYDROXYTYROSOL has been shown to have cardioprotective, anticancer, neuroprotective, endocrine-protective, and antimicrobial effects. Many of these effects are due to its

high antioxidant activity: this phytonutrient acts as a free radical scavenger and metal chelator, and it also increases endogenous defense systems against oxidative stress through activating various cellular signaling pathways. TYROSOL is a hydroxytyrosol derivative that can inhibit oxidative damage, and has been shown to have beneficial effects against coronary heart disease, obesity, insulin resistance, hypertension, atherosclerosis, chronic heart failure, osteopenia and Alzheimer's disease.

OLEOCANTHAL is the phenylethanoid responsible for the slight burning sensation that happens in the back of the throat when eating olive oil. It has demonstrated strong antioxidant and anti-inflammatory properties, acting as a non-selective inhibitor of cyclooxygenase (COX) similar to non-steroidal anti-inflammatory drugs. In fact, a mere 50 grams of olive oil yields an amount of oleocanthal with an anti-inflammatory effect equivalent to 1/10 of an adult ibuprofen dose. In animal models, it has anti-Alzheimer's effects and anticancer activity.

OLEUROPEIN has significant blood pressure lowering effects, powerful antioxidant activity, the ability to protect the hypothalamus from oxidative stress (by improving mitochondrial function through activating the Nrf2-mediated signaling pathway), cardioprotective qualities, anticancer potential, anti-angiogenic activity, and neuroprotective functions (it prevents the toxic aggregation of amyloid beta and tau). And, OLEACEIN is one of the most abundant phenolic compounds in olive oil, and possesses anti-inflammatory, antiproliferative, antioxidant, and antimicrobial activity. It can activate cytoprotective pathways and suppress oxidative stress in cells, and acts as an inhibitor of enzymes related to hyperglycemia and hypertension.

Other Phenolic Compounds

Other phenolic compounds that have been well-researched yet don't fit solidly into one of the above polyphenol or non-polyphenol classes include: gingerol (abundant in ginger), phenylethanoids (abundant in olives), capsaicin (which gives hot peppers their heat) and piperine (which gives black pepper its pungency).

CAPSAICIN'S beneficial effects include: analgesic effects, antihypertensive properties (inducing the release of the neurotransmitter CGRP, in turn reducing blood pressure), cardioprotective effects (such as through reducing foam cell formation, inhibiting platelet aggregation, protecting against LDL oxidation in vitro, and decreasing atherosclerotic lesions in mice), anti-cancer properties (playing a role in apoptosis, cell cycle arrest, and angiogenesis; capsaicin has been shown to induce apoptosis in over 40 different cancer cell lines), airway-protective properties (including improving allergic rhinitis and asthma), gastroprotective properties (through modulating sensory neurons in the gut), and bladder-protective properties.

PIPERINE has demonstrated a number of health effects, including anticancer properties (inhibiting proliferation, metastasis, and angiogenesis in breast cancer, lung cancer, prostate cancer, cervical

cancer, ovarian cancer, and gastrointestinal cancers cells), antioxidant activity, anti-diabetic properties, anti-obesity potential, cardioprotective qualities, anti-aging potential, neuroprotective properties, hepatoprotective properties, anti-allergic activity, immunomodulatory effects, antioxidant activity, and anti-inflammatory activity.

GINGEROL has been shown to exhibit anti-inflammatory, antioxidant, neuroprotective, gastro-protective, and anticancer properties (including against leukemia, breast, skin, prostate, ovarian, lung, colorectal, and pancreatic cancer cells), neuroprotective effects and antimicrobial properties.

Non-Phenolic Phytonutrients

Of course, polyphenols and other phenolic compounds aren't the only show in town; there are some other super-important phytonutrients.

Chlorophyll

Chlorophyll traps light for photosynthesis and is the pigment that gives plants their green color. But this compound plays a beneficial role for humans, too! Chlorophyll is capable of binding to carcinogens (by forming tight molecular complexes) and inhibiting their absorption in the intestines, leading to lower levels reaching body tissues and causing harm. In fact, chlorophyll binds to some of the most widespread foodborne carcinogens, including polycyclic aromatic hydrocarbons (PAHs) and heterocyclic amines (HAs, which can form when cooking meat at high temperatures) and aflatoxin-B1 (which can contaminate peanuts, corn, other cereal grains, pistachios, Brazil nuts, dried spices, and dried fruit—especially when those items were grown and processed in warmer climates).

On top of that, chlorophyll can exert anticancer effects through another avenue: inhibiting cytochrome P450 (CYP450) enzymes and increasing the activity of a phase II detoxification enzyme called quinone reductase. Enzymes in the CYP450 family are required to turn certain chemicals into active carcinogens, and when their enzymatic activity is reduced, those potential carcinogens don't get converted into truly harmful metabolites. Likewise, phase II detoxification enzymes help the body eliminate carcinogens and other harmful substances, so ramping up their activity can also help fight the early phases of cancer.

Where can we find this fantastic phytonutrient? Chlorophyll is rich in dark green leafy veggies, especially spinach, parsley, and arugula, as well as green beans and sugar snap peas. Any green veggie or fruit (I'm

Betalains

Betalains are a class of red to yellow pigments found in certain plants, including beets (in which they were first identified), chard, amaranth, cactus pear, pitahaya (dragon fruit), and some species of wild mushrooms. There are about 80 well-characterized betalains, which can divided into two subclasses: BETACYANINS (red to violet, including betanin, isobetanin, probetanin, and neobetanin) and BETAXANTHINS (yellow to orange, including vulgaxanthin, miraxanthin, portulaxanthin, and indicaxanthin). Interestingly, even though they appear to have very similar if not identical functions, anthocyanins and betalains have never been found together in the same plant.

Betalains demonstrate a variety of health-promoting biological activities, most notably as powerful antioxidants. Betalains scavenge free radicals (a.k.a. reactive oxygen species) and can inhibit lipid peroxidation and LDL cholesterol oxidation. They have antiviral, antifungal, antiprotozoal, and antibacterial activity, including inhibiting the growth of a very wide range of pathogens. Betalains have anticancer properties, inhibiting growth and inducing apoptosis of a variety of malignant cell types in addition to preventing DNA damage. They have been shown to lower serum glucose levels, decrease the postprandial glucose response and insulin secretion (even in people drinking 300 grams of glucose together with 250mL of beetroot juice) and even protect against complications of diabetes, such as kidney injury. Betalains improve lipid profiles, including reducing total cholesterol, triglycerides and LDL cholesterol while increasing HDL cholesterol. In a clinical trial of obese people, consuming 28 grams of freeze-dried red beet leaves resulted in improved serum lipids as well as weight loss. Furthermore, betalains have hepatoprotective effects and improve detoxification via increased phase II detoxification enzymes. Animal models demonstrate neuroprotective properties of betalains as well, with potential benefit for neurodegenerative diseases including Alzheimer's and Parkinson's disease. Betalains also have anti-inflammatory effects through similar pathways to curcuminoids.

Terpenoids

Terpenoids, also known as isoprenoids, are a large and diverse class of naturally occurring organic chemicals derived from the 5-carbon compound isoprene (with the formula $CH_2=C(CH_3)-CH=CH_2$), and the isoprene polymers called terpenes, responsible for the distinct aroma, flavor and colors of many plants. Terpenoids are broadly categorized based on the number of isoprene molecules they contain.

CAROTENOIDS

Carotenoids (tetraterpenoids, containing eight isoprenes) are a diverse group of phytonutrients that are responsible for giving fruits and vegetables vibrant red, orange, and yellow pigmentation. They were one of the earliest phytonutrients ever investigated by scientists (with research dating back to the 1800s!). Across studies, eating foods high in carotenoids appears to reduce the risk of head and neck cancers, supports vision health (particularly age-related eye diseases), may protect against metabolic syndrome and diabetes, and can reduce inflammation. Carotenoids have strong antioxidant properties, and help facilitate communication between cells by promoting the synthesis of connexin proteins, which create gap junctions in cell membranes that allow small molecules to be exchanged (which is part of how cells "talk" to each other!). In the gut, dietary carotenoids can improve the gut immune system maturation and enhance immunoglobulin A production. In the microbiota of pregnant women, dietary and plasma carotenoid levels are associated with greater microbial diversity. Consuming carotenoids with fat significantly increases their absorption.

Most of us are already familiar with beta-carotene, but there are actually more than 600 different carotenoids out there. They can broadly be divided into carotenes (orange content pigments) and xanthophylls (yellow pigments). The most extensively studied (and relevant to human health), include the following.

CAROTENES:

- ALPHA-CAROTENE (α-carotene) has antioxidant and potential anticancer activity; evidence is mixed showing whether alpha-carotene is associated with lower risk of cardiovascular disease. After central cleavage, it's converted to biologically active retinol (vitamin A). A meta-analysis of 34 observational studies found that α-carotene is inversely associated with prostate cancer risk. It's the second most common form of carotene. Found in carrots, pumpkins, maize, tangerine,

orange, sweet potatoes, winter squash, broccoli, green beans, avocado, lettuce, collards, spinach, persimmons, and turnip greens.

- **BETA-CAROTENE** (β-carotene) is know for its provitamin A activity (meaning it can be converted into vitamin A by your body), but it also is a strong immune enhancer that neutralizes free radicals and reduces the risk of some cancers and cardiovascular disease. Research has also shown a favorable effect of β-carotene on insulin sensitivity (possibly due to positively regulating adiponectin), potential benefits for lead poisoning (due to its antioxidant action), chemotherapeutic activity for neuroblastoma, radioprotective activity, an ability to inhibit cell proliferation and arrest cancer cells at multiple phases of the cell cycle (reducing cancer risk), and an ability to inhibit cholesterol absorption in the intestine. Found in dark leafy greens like kale and spinach, and fruits and vegetables colored red, orange, and yellow (including carrots, sweet potatoes, red and yellow peppers, winter squash, cantaloupe, mangoes, and apricots).
- **LYCOPENE** is a potent antioxidant (it has ten times more free radical scavenging ability than α-tocopherol) with anti-inflammatory, cognitive enhancing, and neuroprotective properties. It has been shown to benefit prostate cancer—more specifically, reducing the risk of aggressive forms of the disease. In observational studies, high lycopene intake is associated with a lower risk of chronic diseases like cardiovascular disease, cancer (especially laryngeal, oral, and pharyngeal cancers), and neurological disorders, although scientists are still researching its precise mechanisms of action. It may modulate the cellular redox environment, exert antineuroinflammatory effects via inhibiting lipopolysaccharide-induced expression of COX2 in microglia nuclei, and protect LDL cholesterol from oxidizing. In the gut, lycopene has antimicrobial activity against some pathogens, while promoting the growth of important probiotic speicies. Found in tomatoes (especially processed tomatoes), watermelon, pink grapefruit, guava, and papaya.
- **NEUROSPORENE** is a red-colored carotenoid with powerful antioxidant activity, demonstrating UV-B radiation protective abilities. Found in chicory, poppy, and gourds.
- **PHYTOFLUENE** and phytoene are carotenoid precursors to lycopene. They have powerful UV absorption abilities; they've been shown to accumulate in human skin and potentially protect it against damage through multiple mechanisms (acting as antioxidants, anti-inflammatory agents, and UV absorbers). Found in tomatoes, star fruit, sweet potato, carrots, apricots, and oranges.

XANTHOPHYLLS

- **BETA-CRYPTOXANTHIN** (β-cryptoxanthin) is a common carotenoid with higher bioavailability than α- or β-carotene, and is converted to vitamin A in the body. It has antioxidant activity, and its consumption is associated with a reduced risk of laryngeal, oral, and pharyngeal cancers; some studies also suggest it could act as a chemopreventive agent against lung cancer. In tissue

cultures, it has been shown to have a direct stimulatory effect on bone formation while inhibiting bone resorption, and postmenopausal women with osteoporosis have been shown to have lower levels of this carotenoid compared to non-osteoporotic women. Found in orange and red fruits and vegetables, including sweet red peppers, oranges, pumpkin, papaya, tangerines, carrots, yellow corn, and watermelon, egg yolk, butter, and apples.

- ASTAXANTHIN is a reddish pigment with potent antioxidant properties. A variety of *in vitro* and *in vivo* studies have demonstrated its anti-inflammatory, anticancer, cardioprotective, antihypertensive, immunomodulating, antidiabetic, hepatoprotective, neuroprotective, bone-protective, eye-protective, performance enhancing, and endocrine-supportive properties. It's been shown to alter the gut immune system, significantly lowering bacterial loads and alleviating gastric inflammation in *H. pylori*-infected mice. It can improve gut microbiome composition. Found in seaweeds and algae, and biomagnified in shellfish and fish that feed on that algae (such as salmon, shrimp, lobster, and some crabs).
- CANTHAXANTHIN is a red-orange carotenoid with powerful antioxidant activity, including potentially protecting LDL cholesterol from oxidation. It can induce catalase and superoxide dismutase, has immunomodulatory activity (including enhancing the function and proliferation of immune competent cells), and plays a role in gap junction communication (including the induction of the transmembrane protein connexin 43). Found in paprika, mushrooms, crustaceans, fish, and eggs.
- BETA-CRYPTOXANTHIN (β-cryptoxanthin) serves as a vitamin A precursor and is also associated with a lower risk of some cancers (including lung, colon, and bladder), has anti-obesity activity, is a powerful antioxidant, may help prevent bone loss in a way that's unique among carotenoids (promoting osteoclast formation and inhibiting the actions of osteoblasts), is anti-inflammatory, and may beneficially modulate some aspects of immune function. Compared to other carotenoids, it tends to be much better absorbed by humans (in one study, β-cryptoxanthin-rich foods were 725% more bioavailable than β-carotene-rich foods). Found in mango, butternut squash, persimmons, Hubbard squash, hot chili peppers, tangerines, oranges, papayas, peaches, sweet corn, carrots, kumquats, avocados, peas, grapefruit, and kiwi.
- FUCOXANTHIN has antioxidant properties, as well as potential antiobesity, antidiabetic, anticancer, anti-inflammatory, cardiovascular-protective, and liver-protective properties. More specifically, fucoxanthin supplementation has been shown to significantly reduce cholesterol and triglyceride levels in the blood, correct glucose metabolism abnormalities in muscle tissue (giving it antidiabetic potential), and can even induce fat loss while inhibiting the differentiation and proliferation of fat cells. It also has antibacterial activity, acting against some pathogens. Found in brown seaweeds such as hijiki, kombu, and wakame.

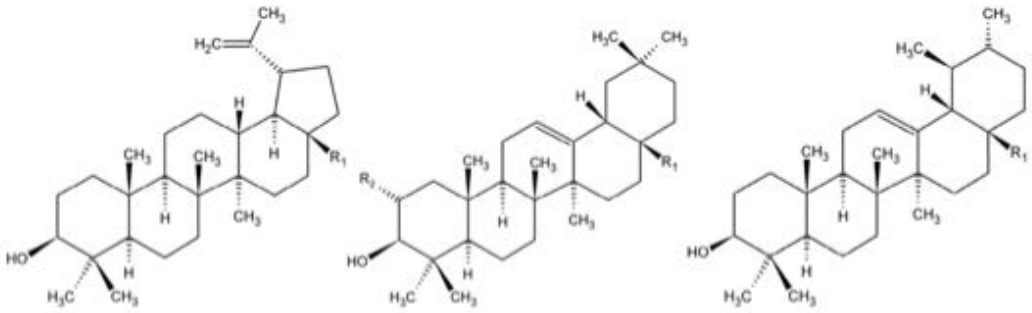
- LUTEIN AND ZEAXANTHIN are known as macular pigments. Due to their high concentration in the retina and their ability to filter harmful blue-light rays, lutein and zeaxanthin play a major role in maintaining eye health, protecting critical parts of the eye from light-induced oxidative damage. As a result, they've been implicated in prevention and treatment of age-related macular degeneration, protecting against cataracts and reducing the risk of retinitis pigmentosa. In addition, numerous studies have shown a wide range of other potential pharmacological activities for lutein and zeaxanthin, including antioxidant, anti-inflammatory, anticancer, antidiabetic, atherosclerotic-protective, lung-protective, immunomodulating, and skin effects, as well as cognitive benefits. A 2016 systematic review and meta-analysis covering 71 articles and a total of 387,569 participants, showed a 12% lower risk of coronary heart disease, 18% lower risk of stroke, and a 25% reduced risk of metabolic syndrome, for the highest compared to lowest tertile of lutein intake. Found in spinach, turnip greens, romaine lettuce, eggs, red pepper, pumpkin, mango, papaya, oranges, kiwi, peaches, squash, brassicas, prunes, sweet potatoes, honeydew melon, rhubarb, plum, avocado, pear, cilantro, wolfberry, kale, turnip greens, and corn.

TRITERPENES

The largest group of phytonutrients, although not as thoroughly studied as polyphenols, is triterpenes (containing six isoprenes) – over 30,000 of which have been identified broadly as phytochemicals, an as yet unidentified number of which are phytonutrients (the difference being how they're used by the human body). Broadly, triterpenes have anti-inflammatory, immunomodulatory, antiviral, anti-HIV, anticancer, insecticidal, anti-diabetic, neuroprotective, hepato-protective, and cardiovascular-protective properties. While triterpenes can be found in many foods and concentrated in fruit skins, alliums, mushrooms, herbs and spices, they are also typically the compounds responsible for the properties of medicinal plants. In fact, over 100 drugs currently used in the USA are based on triterpenes isolated from medicinal plants.

It is estimated that the daily triterpene intake in the United States is approximately 30 mg per kg but that intake reaches 400 mg per kg in Mediterranean countries, attributable to the high triterpene content of olive oil as well as higher intake of vegetable and fruit sources of triterpenes. The health benefits of triterpenes may be a major driver of the health benefits of a Mediterranean diet, including reduced risk of cardiovascular disease, type 2 diabetes, cancer, depression, dementia and cognitive decline due to aging, and inflammatory and autoimmune conditions such as rheumatoid arthritis.

Triterpenes can be further subdivided into at least 200 groups based on small distinctions in the complex structure of their molecular skeletons, but the best-studied and most common triterpenes in the human diet come from the ursane, oleane and lupane groups.



LUPANE OLEANANE URSANE

TRITERPENE CHARACTERISATION

Triterpene family	Triterpene	R1	R2	M [g/mol]	Abbreviation
LUPENE	lupeol	CH_3		426.70	LU
	betulin	CH_2OH		442.72	BE
	betulinic acid	COOH		456.71	BA
OLEANANE	β-amyrin	CH_3	H	426.70	bAM
	erythrodiol	CH_2OH	H	442.72	ER
	oleanolic acid	COOH	H	456.71	OA
	maslinic acid	COOH	OH	472.70	MA
URSANE	α-amyrin	CH_3		426.70	aAM
	uvaol	CH_2OH		442.72	UV
	ursolic acid	COOH		456.71	UA

Adapted from Jäger, Sebastian & Trojan, Holger & Kopp, Thomas & Laszczyk, Melanie & Scheffler, Armin. (2009). Pentacyclic Triterpene Distribution in Various Plants – Rich Sources for a New Group of Multi-Potent Plant Extracts. Molecules (Basel, Switzerland). 14. 2016-31. 10.3390/molecules14062016.

THE URSANE GROUP

The ursane triterpene group includes the most abundant triterpenes in the human diet.

URSOLIC ACID is the dominant triterpene in the American diet because it is the main triterpene in apple peels. In addition to apples, it is found in a variety of other edible plants, including blueberries, cranberries, peppermint, lavender, oregano, basil, holy basil, rosemary, thyme, and prunes. Ursolic acid has many beneficial properties, including antioxidant, anti-inflammatory, anti-atherosclerotic, anti-thrombotic, antibacterial, antifungal, anti-diabetic, neuroprotective, hepatoprotective, cardioprotective effects.

Animal studies have revealed a variety of potential pharmacological benefits for ursolic acid. For example, when mice fed a high-fat diet were supplemented with ursolic acid, they had

increased muscle mass and strength, improved glucose tolerance, reduced severity of hepatic steatosis, and both increased brown adipose tissue and decreased white adipose tissue. In diabetic rats, ursolic acid improved pancreatic beta cell function. In another study of ethanol-fed rats, supplementing with ursolic acid reversed liver damage and increased antioxidants in the blood including glutathione, ascorbic acid (vitamin C) and α-tocopherol (vitamin E). In separate studies, ursolic acid induced neural regeneration after sciatic nerve injury in mice, improved cognitive deficits in mouse models of neurodegenerative disease, and showed antidepressant effects comparable to antidepressants. And, in a mouse model of multiple sclerosis, ursolic acid reversed myelin sheath damage by suppressing Th17 cells and activating oligodendrocytes. It definitely puts the aphorism "an apple a day keeps the doctor away" into a new perspective!

UVAOL is one of several triterpenes abundant in olives and virgin (unrefined) olive oil, but is also found in a few other foods, including guava. Uvaol has anti-inflammatory, anti-oxidant, and anti-hypertensive effects in addition to protecting against DNA damage and inhibiting breast cancer cell growth *in vitro*.

ASIATIC ACID is found in mustard greens, chicory, basil, sage, starfruit, guava, pomegranate and some citrus. It has antioxidant, anti-inflammatory, antihypertensive, nootropic, neuroprotective, cardioprotective, antimicrobial and antitumor activities, and has therapeutic potential for wound healing, liver fibrosis, stroke, dementia, diabetes, obesity, metabolic syndrome, and Alzheimer's and Parkinson's diseases.

THE OLEANANE GROUP

Many members of the oleanane triterpene were first identified in olives.

OLEANOLIC ACID is abundant in olives, virgin olive oil and the peel of grapes, but has also been identified in over 120 plant species. It has anti-inflammatory, immunomodulatory, anti-hypertensive, antitumor, antidiabetic, anti-atherosclerotic and cardioprotective properties. In animal studies, it has shown benefits to allergic asthma, colitis, multiple sclerosis, gastric ulcers and wound healing. It has also been shown to have antimicrobial activity against pathogens like *Listeria monocytogenes, Enterococcus faecalis* and *Enterococcus faecium*.

ERYTHRODIOL is abundant in olives and virgin olive oil. It has antioxidant, anti-inflammatory, anti-cancer, antihypertensive and cardioprotective effects. In an animal model of multiple sclerosis, supplementation with erythrodiol improved neurological symptoms. It also appears to be a major contributor to olive oil's cholesterol lowering properties by enhancing macrophage cholesterol efflux, where cholesterol is removed from cells in the artery wall after which it can be excreted into bile and feces.

MASLINIC ACID is also abundant in olives and virgin olive oil, but has also been found in other edible plants including spinach, eggplant, chickpeas and pomegranate. It has anticancer, anti-inflammatory, antimicrobial, antiparasitic, antihypertensive, and antioxidant activities. It has been shown to reduce serum cholesterol, including reducing total cholesterol and LDL cholesterol.

β-AMYRIN is one of several amyrins abundant in tomatoes, but is also found in other plants such as persimmon. It is a very strong antioxidant and anti-inflammatory as well as having anticancer and antidiabetic properties. In a mouse study of arthritis, supplementation with β-amyrin reduced both acute and chronic inflammatory processes as well as reducing hypersensitivity and edema. And in a mouse model of diabetes, supplementation with β-amyrin reduced serum glucose via preservation of pancreatic beta cell integrity, as well as reducing serum total cholesterol, VLDL and LDL cholesterol and triglycerides while increasing HDL cholesterol.

THE LUPANE GROUP

The lupane triterpene group are widely distributed in low levels among edible plants.

LUPEOL is the main triterpene in mango but can also be found in a variety of vegetables such as cabbage, peppers, cucumber, tomato, carrot, peas, strawberry, olives, grapes, fig, black tea, capers and dandelion. It has strong anticancer and anti-inflammatory effects, in addition to antioxidant, antimicrobial, antiprotozoal, and cardioprotective effects. Studies comparing the anti-inflammatory effects of lupeol to the non-steroidal anti-inflammatory drug indomethacin showed lupeol to be more effective at reducing inflammation. Lupeol also reduced airway inflammation in a mouse model of asthma. Studies have shown that topical treatment with lupeol accelerates wound healing while minimizing scarring. And, in addition to inhibiting the growth of cancer cells, various studies have shown that lupeol may have strong potential as a cancer treatment.

BETULIN is found in many plants, most notoriously birch bark, and in edible plants is particularly abundant in nuts (especially walnuts and hazelnuts), sage, grapes, persimmons and chaga mushrooms. It has anticancer, anti-inflammatory, anti-ulcer, antidiabetic, antihyperlipidemic, and antimicrobial (including antiviral, antibacterial, antimalarial and anti-HIV) properties. In diabetic rats, supplementing with botulin reduced postprandial serum glucose, and in separate studies it was found to enhance insulin sensitivity, and reduce the development of atherosclerotic plaques. Betulin inhibits the growth of many known pathogenic bacteria—including *Escherichia coli, Staphylococcus aureus* and *Enterococcus faecalis*. Topical application of botulin has also been shown to speed wound healing while reducing scarring.

BETULINIC ACID is found in rosemary, basil, apples, quince, persimmon, grapes, chicory, jackfruit, walnuts, olives, and pomegranate. It has anti-inflammatory, antioxidant, anticancer, anti-athlerosclerotic, anti-obesogenic, antimicrobial (including anti-HIV, antibacterial, antimalarial, antihelmintic, and anti-HSV-1), and cardioprotective properties. Betulinic acid has shown to be cytotoxic to a variety of cancer cell types, including melanoma, neuroblastoma, medulloblastoma, glioblastoma, head and neck cancer, ovarian carcinoma, cervix carcinoma, lung carcinoma, and leukemia. In fact, betulinic acid also shows promise as a cancer treatment and as an HIV treatment. And, in another study, extracts of rosemary rich in betulinic acid had antidepressant effects.

PLANT STEROLS AND STANOLS

Plant sterols and stanols (together, referred to as phytosterols) are triterpenes with a steroid hormone structure but that also belong to other sub-groups of triterpenes. As a result of their structural similarity to cholesterol, they can block cholesterol absorption and reduce atherosclerotic risk; research has shown that eating at least 2 grams of plant sterols per day can lower LDL cholesterol by 5 to 10%. In the gut, plant sterols have been shown to decrease levels of the *Erisipelotrichaceae* family and increase the abundance of *Eubacterium* species. The dominant plant sterol in the human diet is **SITOSTEROL**, while the stanols **STIGMASTEROL** and **CAMPESTEROL** make up about 5% of the average dietary phytosterol intake. Phytosterols are found in legumes, seeds, nuts, olive oil and other plant oils, as well as most whole grains, fruits and vegetables. They can help block absorption of cholesterol in the small intestine, due to

having a similar chemical structure to animal cholesterol. As a result, these phytonutrients can help reduce high levels of LDL cholesterol in the blood (without impacting HDL levels) and potentially reduce the risk of heart disease.

Some sterol triterpenes have additional benefits beyond cholesterol metabolism. For example, GANODERIOLS isolated from reishi mushrooms have strong anticancer, anti-inflammatory, antioxidant, and anti-HIV properties. WITHANOLIDES found in vegetables of the nightshade family also have strong anticancer and anti-inflammatory properties. And, CUCURBITACINS, which are found in the *Cucurbitaceae* family (which includes squash winter and summer), gourds, cucumbers and melons) and are responsible for the bitter taste of some of these foods, have anti-inflammatory, anticancer, antidiabetic and cardioprotective properites.

DITERPENES

Diterpenes (containing four isoprenes) are formed by plants, fungi, and animals via the HMG-CoA reductase pathway, and possess anti-inflammatory and antimicrobial activity. Diterpenes of particular note include labdane, cafestol and kahweol.

LABDANE is a natural bicyclic diterpene with antibacterial, antifungal, antiprotozoal, and anti-inflammatory activities. Its anti-inflammatory properties appear due to inhibiting nuclear factor-κB (NF-κB) activity, modulating arachidonic acid (AA) metabolism, and reducing nitric oxide (NO) production. Labdane is found in members of the ginger family, *Asteraceae*, and *Lamiaceae*.

CAFESTOL and KAHWEOL are diterpenes considered responsible for many of the biological and pharmacological effects of coffee, including chemopreventive qualities, hepatoprotective activity, antidiabetic activity, and anti-osteoclastogenesis activity. However, cafestol also appears to raise levels of blood cholesterol. Kahweol may benefit skeletal health by inhibiting osteoclast differentiation, and also has anti-inflammatory and anti-angiogenic effects, making it potentially protective against cancer; specifically, it inhibits both COX2 expression and MCP-1 secretion in endothelial cells and increases glutathione levels. Cafestol and kahweol are found in coffee beans in unfiltered form such as French press coffee or Turkish coffee/Greek coffee.

MONOTERPENES

Monoterpenes are a class of terpenes with two isoprene units. In general, they've demonstrated anticarcinogenic properties, inhibiting the post-translational isoprenylation of Ras and other cell growth-regulatory proteins, inducing apoptosis, and increasing the expression of transforming growth factor-β in tumors. A variety of other beneficial effects are delivered by individual monoterpenes, including: antioxidant, anti-obesity, respiratory-supportive, antiseptic, diuretic, decongestant, antispasmodic, anticonvulsant, analgesic, anti-diabetic, antimicrobial, muscle relaxant properties, and even anti-anxiety activity.

Monoterpenes include LIMONENE (abundant in oils of citrus, cherries, spearmint, dill, garlic, celery, maize, rosemary, ginger, and basil), PERILLYL ALCOHOL (found in citrus oils, lavender, celery seeds, tart cherries, hops, caraway, and mints), CARVONE (found in the essential oils of caraway, spearmint, ginger grass, and dill), MYRCENE (found in cannabis, hops, thyme, lemon grass, mango, cardamom, and bay), menthol (found in mints), THYMOL (found in thyme, star anise, oregano, bee balm, and marjoram), LINALOOL (found in citrus fruits, lavender, cannabis, hops, cinnamon, mints, and rosewood) and PINENE (found in pine needles, rosemary and basil).

SESQUITERPENES

Sesquiterpenes are terpenes that consist of three isoprene units, and have demonstrated immune-boosting properties, antioxidant activity, and anticancer potential. Of particular note are β-caryophyllene and humulene.

β-CARYOPHYLLENE has anti-inflammatory and pain-relieving properties, with animal studies showing that it can reduce nerve pain from inflammation. It also has demonstrated potent inhibition against clonogenicity, migration, invasion and spheroid formation in colon cancer cells, making it potentially helpful against cancer. It has antibacterial activity against the pathogen *Staphylococcus aureus*. Found in black pepper, cloves, hops, caraway, lavender, cinnamon, oregano, basil, ylang-ylang, rosemary, and cannabis.

HUMULENE is a sesquiterpene with the potential to reduce allergic inflammation in the airways, making it potentially valuable for asthma. It also has antibacterial activity against *Bacteroides fragilis* and its biofilms. Found in hops and cannabis.

Plant Organosulfur Compounds

Plant organosulfur compounds are bioactive sulfur-based molecules; and while there are many classes and subclasses of organosulfur compounds, the three most important classes are thiosulfinates found in alliums (the onion family) and isothiocyanates and indoles found in cruciferous vegetables (the cabbage family).

THIOSULFINATES

Thiosulfinates are the compounds responsible for the distinctive pungent flavor of allium vegetables (such as onions, garlic, shallots, and leeks); and interestingly, they aren't even formed until the vegetable is damaged, for example sliced, crushed or chewed. This is because their precursors—antioxidant and immune-modulating S-alk(en)yl-L-cysteine sulfoxides (like ALLIIN, the dominant sulfoxide in garlic; METHIIN, found in garlic, onions, leeks, and shallots; PROPIIN found in shallots; and ISOALLIININ, the dominant sulfoxide found in onions and shallots)—reside in storage cells whereas the lyase enzyme *alliinase* (which is quite heat stable) that metabolizes sulfoxides is found in bundle sheath cells. When the cell membranes are damaged, alliinase and sulfoxides mix, forming a variety of thiosulfinates.

Thiosulfinates provide diverse beneficial effects, including powerful anticancer properties as well as antioxidant, anti-inflammatory, and antithrombotic effects. In general, thiosulfinates exert their effects by modulating important enzymes (like the cytochrome P450 superfamily and glutathione S-transferases) that help detoxify carcinogens and prevent DNA adducts from forming.

While at least 19 beneficial thiosulfinates have been identified in various alliums, the most famous example is ALLICIN, produced by the conversion of the alliin in garlic by alliinase when the garlic is sliced or crushed. Allicin has well-established anticancer and antitumor, cardioprotective (including reducing hypertension and hyperlipidemia as well as improving circulation), antibacterial, antifungal and antiparasitic properties in addition to immune modulating properties. In fact, garlic consumption as been shown to improve cardiovascular health (specifically, by lowering total cholesterol and LDL cholesterol, by inhibiting the enzymes involved in cholesterol and fatty acid synthesis, and by reducing platelet clumping and clot formation), reduce risk of gastrointestinal and prostate cancer, and support detoxification

processes through induction of phase II enzymes that help remove toxic substances and carcinogens from the body.

Thiosulfinates are unstable molecules, and depending on the pH, temperature, and presence of solvents, can decompose into a further variety of beneficial organosulfur compounds, including (but not limited to): diallyl sulfide, diallyl disulfide, diallyl trisulfide, ajoene, and S-allyl cysteine. These compounds also have health-promoting properties. For example, DIALLYL SULFIDE can boost the detoxification functions of the liver, increase production of the antioxidant enzyme glutathione S-transferase, and has hepatoprotective, cardioprotective, and anticancer effects. Diallyl disulfide and DIALLYL TRISULFIDE have wide-ranging anticancer properties. Diallyl trisulfide additionally has cardioprotective properties and can boost immune activity against viruses. AJOENE is a powerful antioxidant with antithrombotic, anticancer, antiviral, antibacterial and antifungal properties. And, S-ALLYL CYSTEINE has antioxidant, anti-inflammatory, anticancer and neuroprotective properties.

ISOTHIOCYANATES

Isothiocyanates are the metabolites of glucosinolates, the biologically inactive compounds responsible for the distinctive flavor—including bitterness, sulfurous aroma, and pungency—of cruciferous vegetables (such as broccoli, cabbage, kale, Brussels sprouts, and cauliflower). Similar to thiosulfinates, isothiocyanates are formed when the vegetable is damaged (for example, sliced, crushed or chewed), and the glucosinolates are able to mix with the vacuolar hydrolase enzyme *myrosinase*, which hydrolyses the glucosinolates into isothiocyanates. However, unlike alliinase, myrosinase is not heat stable, so isothiocyanates are only formed when the raw vegetable is damaged. (We do have gut bacteria that produce myrosinase, so some isothiocyanates can be formed after we eat cooked cruciferous vegetables.) Isothiocyanates are particularly well-known for their anticancer properties and some types of isothiocyanates can upregulate genes involved in protecting against DNA damage, inflammation, and oxidative stress, as well as increase the activity of phase II enzymes (such as quinone reductase and glutamate cysteine ligase) that help remove toxic substances and carcinogens from the body.

The most famous isothiocyanate is sulforaphane, which is formed when myrosinase hydrolyses a glucosinolate called glucoraphanin into sulforaphane. SULFORAPHANE has been studied for its ability

to halt cancer cell growth, kill cancer cells, upregulate a number of phase II detoxification enzymes, and protect healthy cells from damage from environmental carcinogens. Sulforaphane also upregulates a variety of protective antioxidant enzymes, including glutathione S-transferase (GST), heme oxygenase-1 (HO-1), quinone reductase (QR), and UDP-glucuronosyltransferase (UGT).

Sulforaphane improves glycemic control in patients with obesity and poorly controlled type 2 diabetes as well as reduces hepatic gluconeogenesis. It has powerful anti-inflammatory effects, delays progression of osteoarthritis, and is cardioprotective. Sulforaphane has also shown efficacy for neurodegenerative diseases, including Alzheimer's, Parkinson's, and multiple sclerosis. It also has antimicrobial activity, including antibacterial effects—in fact, sulforaphane has been shown to suppress the growth of *Helicobacter pylori*, the bacteria associated with gastric ulcers and increased risk of gastrointestinal cancers.

INDOLES

Indoles are tryptophan-based molecules also produced by myrosinase hydrolysis of glucosinolates. In fact, glucosinolates can be grouped into three chemical classes: aliphatic, indole and aromatic, according to whether their amino acid precursor is methionine, tryptophan, and phenylalanine, respectively. Myrosinase metabolizes these glucosinolates into a variety of compounds, including the already discussed isothiocyanates, as well as thiocyanates, nitriles and indoles. Indoles have powerful anticancer properties through multiple mechanisms that include modulation of phases I and II detoxification enzymes, regulation of cell cycle arrest, control of cell growth, induction of apoptosis, antioxidant activity, anti-angiogenic effects, and epigenetic regulation.

The major product of myrosinase hydrolysis of indole glucosinolates is **INDOLE-3-CARBINOL (I3C)**, which is formed when myrosinase hydrolyses a glucosinolate called glucobrassicin into I3C. I3C has anticancer, antioxidant, and anti-atherogenic properties. In the stomach, I3C undergoes acid-catalyzed condensation that generates a number of biologically active molecules, most notably **3,3'-DIINDOLYLMETHANE (DIM),** which in addition to its anticancer, anti-inflammatory and immune modulating properties, has a direct and beneficial effect on estrogen metabolism.

The endogenous estrogen 17β-estradiol can be converted to either 16α-hydroxyestrone (16αOHE1) or 2-hydroxyestrone (2OHE1). These are sometimes viewed as 'bad' and 'good' estrogen metabolites, respectively, since 16αOHE1 acts as a breast tumor promoter while 2OHE1 does not and further inhibits angiogenesis and suppresses tumor growth. Higher urinary values for the 2OHE1 to 16αOHE1 ratio (called the 2:16 ratio) reduces risk of breast cancer. Several studies have shown that DIM positively impacts the 2:16 ratio, increasing urinary 2OHE1 levels, and this positive shift in estrogen metabolism could decrease the risk of estrogen-sensitive cancers such as breast cancer and potentially treat postmenopausal osteoporosis.

Whew! That's a pretty impressive array of benefits... and remember, it's just a broad overview of the thousands of helpful phytonutrients that plants contain. These compounds are truly mind-blowing in both their sheer quantity and their value to human health.

Recommended Daily Allowances & Nutrient Targets

> Recommended Dietary Allowances (RDAs) are established by the Food and Nutrition Board of the Institute of Medicine.

An RDA is the dietary intake level of a specific nutrient considered sufficient to meet the needs of 97.5% of healthy individuals, implying that this intake would be inadequate for just 2.5% of the healthy population. RDAs are calculated based on the estimated average requirement for each nutrient, something that some specialists believe is a gross underestimation of our true biological need, since these levels are generally determined based on symptoms of deficiency rather than amounts needed for optimal health. In addition, certain health conditions can increase the need for various nutrients, which is not taken into account—for example, chronic stress depletes vitamin C and increasing vitamin C intake can regulate the stress response.

For some nutrients, no RDA has been established. In those cases, the Institute of Medicine has established a dietary intake level called Adequate Intake (AI), an amount somewhat less firmly believed to be adequate for everyone in the demographic group. For yet other nutrients, where no RDA or AI exists, we can look at large prospective studies and meta-analyses for clues as to how much of that specific nutrient leads to the greatest improvements in overall health and reduction of chronic disease risk.

Macronutrient RDAs and Ratios

Macronutrients—protein, fat, and carbohydrates—supply the energy that fuels the complex functions of life along with being basic building blocks for cellular structures. Eating too little of any macronutrient can result in malnutrition. Inadequate fat can decrease our absorption of fat-soluble vitamins and deprive us of essential fatty acids. Inadequate protein can reduce lean muscle mass, immune function, bone mineral density, and cause a host of problems related to deficiency of essential amino acids. Too few carbohydrates can mean insufficient fiber and micronutrients abundant in vegetables and fruits, including: vitamin C, B vitamins, vitamin K, potassium, magnesium, chromium, and phytonutrients including polyphenols, chlorophyll, carotenoids, isothiocyanates, and thiosulfinates, all of which are important for disease prevention. The solution? We can

balance our macronutrients by eating moderate (neither high nor low) amounts of carbohydrate, fat, and protein.

The Accepted Macronutrient Distribution Ranges (AMDR) were established by the Food and Nutrition Board of the Institute of Medicine using evidence from interventional trials with support of epidemiological evidence that suggests a role in the prevention or increased risk of chronic diseases, and based on ensuring sufficient intake of essential nutrients.

The AMDR is

- 20 TO 35% CALORIES FROM FAT
- 10 TO 35% CALORIES FROM PROTEIN
- 45 TO 65% CALORIES FROM CARBOHYDRATE (but no more than 25% from sugars)

A gram of fat has 9 calories, and a gram of protein or non-fiber carbohydrates has 4 calories. It's worth emphasizing that these calories would ideally all come from nutrient-dense whole-food sources.

In addition, RDAs have been established for fiber and protein.

The recommended daily allowance for fiber is 25 grams per day for women and 38 grams per day for men. This should be viewed as a minimum—traditional cultures consume at least twice this amount, and there is no upper limit to the benefits of high-fiber intake. A better target for most people is 50 grams daily, from a diversity of whole food sources.

The recommended daily allowance of protein is 0.36 grams per pound body weight (0.8 grams per kilogram of body weight). That amounts to 56 grams for a 150-pound person. However, it's important to emphasize that this number is considered a minimum daily allotment, and there is no established upper limit. In fact, many studies have evaluated diets containing three to four times more protein than this minimum and proven benefits to weight management, body composition, hormone regulation, and cardiovascular health. These studies suggest that an optimal protein intake for most people is probably in the range of 1.2 to 1.8 grams per kilogram bodyweight (82 to 122 grams for that same 150-pound person), and that people who are very active may see the best results at even higher intake.

Optimal protein intake depends on your weight, level of physical activity and health goals.

Optimal daily protein intake for adults in grams per kilogram of body weight (g/kg BW)

	Healthy Weight		Overweight	Pregnant	Lactating
SEDENTARY	1.2-1.8		1.2-1.5	1.8	1.5
ACTIVE	1.4-2.0	1.6-2.4		UNKNOWN	
GOAL	MAINTENANCE	MUSCLE GAIN	FAT LOSS		

***Maintenance**: eucaloric diet | **Muscle gain:** eucaloric diet (if sedentary) or hypercaloric diet (if active) | **Fat loss:** Hypocaloric diet*

No RDA is established for total fat or individual fatty acids; however, the World Health Organization recommends an omega-6 fatty acid intake of 2.5–9% of total calories and an omega-3 fatty acid intake of 0.5–2% of calories. In addition, a variety of studies show that higher omega-3 fatty acid intake (at a 1:1 to 1:4 ratio relative to omega-6s) is optimal to support immune, cardiovascular, and neurological health.

RDA for Essential Amino Acids

The following is the World Health Organization recommended daily allowance for the indispensable amino acids for adults. Because of diverse benefits associated with a higher protein intake (20% to 30% of total calories coming from protein), these should be considered minimum targets. It's also worth noting that if you're consuming adequate protein from a diversity of sources, including animal foods, it's nearly impossible not to meet these amino acid targets.

Amino Acid(s)	RDA per kg of Body Weight, for Adults Ages 19-50
HISTIDINE	10 mg
ISOLEUCINE	20 mg
LEUCINE	39 mg
LYSINE	30 mg
METHIONINE	10.4 mg
CYSTEINE	4.1 mg
PHENYLALANINE PLUS TYROSINE	25 mg (TOTAL)
THREONINE	15 mg
TRYPTOPHAN	4 mg
VALINE	26 mg

** Visit usda.gov for RDAs for other age groups as well as recommendations for pregnant and lactating women.*

RDA for Vitamins

Most of us can target the RDA or AI of each vitamin as a minimum every day. However, it is important not to go overboard.

The tolerable upper limit (TUL) is the maximum daily amount of a nutrient that is safe to consume over the long term, established based on scientific evidence and careful risk assessment. Going a little over the TUL once in a while usually isn't a big deal, but regularly exceeding this amount may increase the risk of adverse health effects such as chronic toxicity. Chronic toxicity occurs when someone consumes too much of something on a daily or near-daily basis for a long period of time, typically weeks to months.

In practice, nutrient toxicity is only seen in the context of high-dose supplements and a small handful of foods (like liver, Brazil nuts and kelp) that are so high in certain nutrients that eating too much of them can lead to chronic toxicity. There's no reason to fear liver, Brazil nuts or kelp, but these are foods to moderate since eating large amounts of them daily has been known to cause chronic toxicity of vitamin A, selenium, and iodine, respectively.

It's also worth noting that in many instances, therapeutic doses of essential vitamins and minerals exceed the established upper limits. If you're unsure whether or not your getting too much of any particular nutrient, talk to your doctor.

	RDA	AI	Upper Limit
VITAMIN A	3,000 IU (M)		10,000 IU
	2,300 IU (F)		
VITAMIN B1	1.2 mg (M)		NOT ESTABLISHED
	1.1 mg (F)		
VITAMIN B2	1.3 mg (M)		NOT ESTABLISHED
	1.1 mg (F)		
VITAMIN B3	16 mg (M)		35 mg (from supplemental forms)
	14 mg (F)		
VITAMIN B5		5 mg	NOT ESTABLISHED
VITAMIN B6	1.3 mg (M)		100 mg
	1.3 mg (F)		
VITAMIN B9	400 mcg		1,000 mcg (from supplemental forms)
VITAMIN B12	2.4 mcg		NOT ESTABLISHED
VITAMIN C	90 mg (M)		2,000 mg
	75 mg (F)		
VITAMIN D	600 IU		4,000 IU
VITAMIN E	22 IU		1,500 IU (from supplemental forms)
VITAMIN K		120 mcg (M)	NOT ESTABLISHED
		90 mcg (F)	
BIOTIN		30 mcg	NOT ESTABLISHED
CHOLINE		550 mg (M)	3.5 g
		425 mg (F)	

**Only RDAs for adults aged 19 to 50 are shown, except where otherwise noted: (m) are recommendations for adult males and (f) are recommendations for adult females. Visit https://nutrivore.com/nutrient-daily-values/ for RDAs for other age groups as well as recommendations for pregnant and lactating females.*

RDA for Essential Minerals

Mineral absorption mainly occurs in the small intestine, with minerals being both passively absorbed (simply diffusing across the gut barrier) and actively absorbed (transported into the body via receptor binding in a process that uses cellular energy, ATP). Most minerals have multiple pathways for absorption, which is how the body regulates uptake of dietary minerals to avoid too-high-levels in the body, which may result in toxicity.

For some minerals, the amount in our body can also be regulated by excretion. For example, magnesium, calcium and phosphorus levels are controlled by the kidneys, increasing excretion via urine when serum levels are too high. However, for other minerals, like iron which has no excretion mechanisms, the amount in our bodies is entirely controlled by regulating absorption.

Similar to vitamins, mineral toxicity is typically only seen in the context of high-dose supplementation.

	RDA	AI	Upper Limit
CALCIUM	1,000 mg		2,500 mg
CHROMIUM		35 mcg (M) 25 mcg (F)	NOT ESTABLISHED
COPPER	900 mcg		10,000 mcg
FLUORIDE		4 mg (M) 3 mg (F)	10 mg
IODINE	150 mcg		1,100 mcg
IRON	8 mg (M) 18 mg (F 19-50 YEARS) 8 mg (F 51+ YEARS)		45 mg
MAGNESIUM	400 mg (M 19-30 YEARS) 420 mg (M 31+ YEARS) 310 mg (F 19-30 YEARS) 320 mg (F 31+ YEARS)		350 mg from supplemental forms
MANGANESE		2.3 mg (M) 1.8 mg (F)	11 mg
MOLYBDENUM	45 mcg		2,000 mcg
PHOSPHORUS	700 mg		4 g
POTASSIUM		3400 MG (M) 2600 MG (F)	NOT ESTABLISHED
SELENIUM	55 mcg		400 mcg
ZINC	11 mg (M) 8 mg (F)		40 mg

**Only RDAs for adults aged 19 to 50 are shown, except where otherwise noted: (m) are recommendations for adult males and (f) are recommendations for adult females. Visit https://nutrivore.com/nutrient-daily-values/ for RDAs for other age groups as well as recommendations for pregnant and lactating females.*

Nutrient Targets for Phytonutrients

> How many servings of phytonutrient-rich foods per day do we need?

Science hasn't established an RDA for phytonutrients, but studies have shown that overall mortality was reduced by 30% in participants who ate a diet rich in polyphenols (greater than 650 milligrams/day) as compared with participants who had low polyphenol intakes (less than 500 milligrams/day). For reference, fruits and vegetables typically contain 200 to 300 milligrams per 100-gram serving. Similarly, 15 milligrams per day of glucosinolates (precursors for isothiocyanates and indoles) is associated with significantly reduced cancer risk, and 2 grams per day of phytosterols has been associated with improved serum lipid profiles, reducing cardiovascular disease risk. There doesn't appear to be an upper limit to the benefits we can obtain from a diet rich in phytonutrients.

FRUITS AND VEGETABLES TYPICALLY CONTAIN 200 TO 300 MILLIGRAMS OF PHYTONUTRIENTS PER 100-GRAM SERVING.

When viewed through the lens of phytonutrients, it easy to understand why studies show every serving of vegetables or fruit we eat per day decreases the risk of all-cause mortality by 5%, with the greatest effect seen when we consume eight or more servings per day.

The Nutrivore Score

> If you're feeling like keeping track of so many different nutrient targets is a big job, the Nutrivore Score is here to simplify that task!

The Nutrivore Score is a measurement of nutrient density, i.e., total number of nutrients per calorie. It's a tool to identify the most nutrient-dense options within every food group and subgroup, to inform your day-to-day choices.

Instead of tracking calories, the Nutrivore Score tells you the quality of the calories in a food. And, it's an objective way to measure how nutritious a food is to inform your decision making as you peruse the grocery store shelves. Plus, this simple number helps us to appreciate the nutrients inherent to most foods, while feeling empowered in the knowledge that we're making the right choice in the right way with the right balance.

We'll discuss how the Nutrivore Score is calculated, and more practical applications of the Nutrivore Score in detail; but first, let's examine why the Nutrivore Score is superior to other nutrient-density scores!

The Science of Nutrient Profiling

Scientists have been working towards a standard method for quantifying the nutrient density of foods for about twenty years, but their efforts have been complicated by fuzzy definitions, incomplete nutrient data, lack of clarity on whether certain nutrients (or food groups) should be more or less heavily weighted in a calculation, disagreement on whether a food should be penalized for containing high levels of problematic compounds (like sodium or added sugars), and a misguided desire to retrofit a nutrient density score to align with the USDA dietary guidelines or its proxy, the Healthy Eating Index, rather than analyzing health outcomes or nutrient status test results.

The concept of a nutrient-dense food was first defined in the 1970s as any food that provided "significant amounts of essential nutrients" per serving. Because of a lack of formal criteria for determining whether or not a food met this definition, inconsistent and subjective standards were applied, largely build around broad food groups, and overly focused on fat and sugar content as problematic, rather than vitamins, minerals, and other important nutrients as beneficial. As a result, some foods were labelled as unhealthy, like nuts, olives, and avocadoes, purely because of their fat content—we now recognize all of these foods

contain heart-healthy fats that reduce cardiovascular disease risk. In addition, the terms "good source" and "excellent source" were defined as providing 10% or 20% DV, respectively, of a specific nutrient per serving—for example, if a sugar fruit punch contained 10% DV of vitamin C, it could include the phrase "A good source of vitamin C" on its label.

In the early 2000s, the definition of nutrient density was updated—instead of referring to nutrients per serving, nutrient density is now defined as a measure of nutrients per calorie. This switch came from acknowledging that almost everyone had dietary shortfalls of essential nutrients, while consuming abundant, often overabundant, calories. We needed a way to help people consume more nutrients for each calorie, rather than more servings of foods.

Thus, nutrient profiling was born, the science of categorizing foods according to their nutritional composition. In 2006, the European Commission proposed that nutrient profiles should be used in order to make nutrition and health claims. What followed was the development by scientists of a confusing array of relatively similar methods to quantify the nutritional value of foods, including (but not limited to): Nutrient for Calorie (NFC), Calorie for Nutrient (CFN), Nutritious Food Index (NFI), Naturally Nutrient Rich (NNR) Score, Nutrient-Rich Foods (NRF) Index, Nutrient Adequacy Score (NAS), and Nutrient Density Score (NDS). These scores/indices differ from each other in small but meaningful ways.

Some of these scores (like the NDS) cap a nutrient's contribution at 100% DV, whereas others recognize that a food having more than a 100% DV of a specific nutrient per serving or per 100 calories makes that food a very valuable source of that nutrient! We don't always eat exactly one serving of a food, plus for many nutrients, getting a little more than the daily value is a good thing! Capping a nutrient's contribution to the nutrient density score at 100% hinders our ability to understand the value of that food. For example, Brazil nuts are the most nutrient-dense nut attributable to their very high selenium content—in fact, it would only take about ten Brazil nuts every day to cause chronic selenium toxicity. (Eating ten Brazil nuts every once in a while isn't likely to cause a problem, but to be on the safe side if you eat Brazil nuts every day, limit to three or four.) But, if you capped the contribution of selenium to the calculation of Brazil nut nutrient density, they would erroneously appear to be one of the lowest nutrient-density nuts, perhaps even giving a false sense of security in eating them by the handful. It just makes sense to fully value the awesome selenium content of Brazil nuts, respecting that it's best to not eat too many, and have that reflected in its nutrient density score!

Some scores calculate nutrient density as a function of food weight, which is influenced by nonnutritive compounds like water content, but most represent the nutrient density as a function of energy. Given that our food supply is overabundant in calories while being overall depleted in nutrients, the more important information for the average consumer is how to maximize nutrients for each calorie, rather than for each gram or serving of food.

Some of the scores are normalized (so for example, the range is 0 to 100 or 0 to 1000), whereas others are simply totals. The problem with normalization is communication: while it may seem simpler to represent all foods on a scale from 0 to 100, the immense difference between the nutrient density of vegetables versus, say, fast food, is minimized when the scale is smaller. Some scores also include a weighting by food group, so the most nutrient-dense grain gets allocated the score of 100 in the grains group and the most nutrient-dense vegetable gets allocated the score of 100 in the vegetables group. This good group weighting system completely undermines the entire concept of nutrient profiling. For example, the Nutrivore Score of kale is 4233 whereas the Nutrivore Score of oats is 208, but when you apply a correction for food groups, their nutrient density scores are very similar. Studies show their health benefits are not equivalent, why would be normalize their nutrient-density scores to make them appear to be equally nutrient-dense foods when they clearly aren't?

The other way these scores differ is in the nutrients used to make the calculations. Most include protein and fiber, but the CFN only includes protein and the NFI only includes fiber. Which vitamins are utilized in the calculations ranges from only vitamin C (in the NDS5) all the way to including all of the vitamins except B7 and K (in the NDS15). And which minerals are utilized ranges from just calcium and iron (in the NQI, NRF6, and NDS5) all the way to calcium, iron, zinc, magnesium, copper, iodine, and selenium (in the NDS23). For the NRF and NDS, multiple variations were created, incorporating anywhere from 5 to 23 nutrients into their calculations (hence the number after the acronym, for example NDS5 or NRF23) and either with or without penalizing foods for their sodium, added sugars and saturated fat content (in which case, the acronym has a ".3" added at the end, for example the NRF15.3 includes 15 nutrients in its calculation and penalizes for 3). None of these scores incorporate phytonutrients into their calculations. I would argue that the more nutrients used in the calculus, the easier it is to differentiate between the most nutrient-dense foods and the least.

In fact, there has been much discussion among scientists over which nutrients to include in nutrient profiling calculations. This concern originates from the fact that certain nutrients are more strongly

correlated with health outcomes than others (typically those that we're most likely to be deficient in rather than the nutrient itself being less important), such as high consumption of omega-3 fats, fiber and vitamin D. To attempt to hone in on the best sampling of nutrients to include in a nutrient-density score, a couple of studies have compared the NRF calculated with 5 to 16 nutrients (with or without limits for sodium, sugars and saturated fats, and with our without weighting for various food groups) to the Healthy Eating Index (HEI). The HEI is designed a way to quantify compliance with the USDA dietary guidelines, by assigning an energy adjusted score for servings from 9 food groups or nutrients to encourage (total fruits, whole fruits, total vegetables, greens and beans, whole grains, dairy, total protein foods, seafood and plant protein, and fatty acids ratio) and subtracting servings from 4 food groups or nutrients to discourage (refined grains, sodium, added sugars, and saturated fat). Completely counterintuitively, these studies found that an NRF with fewer nutrients in the calculation better aligned with the HEI, with 9 nutrients (protein, fiber, vitamin A, vitamin C, vitamin E, calcium, iron, magnesium and potassium) being optimal.

WHY WOULD WE RETROFIT A NUTRIENT DENSITY SCORE TO ALIGN WITH DIETARY GUIDELINES THAT WERE CRAFTED WITHOUT NUTRIENT DENSITY OR NUTRIENT SUFFICIENCY IN MIND?

But, here's where this line of reasoning is fundamentally flawed. Why would we retrofit a nutrient density score to align with dietary guidelines that were crafted without nutrient density or nutrient sufficiency in mind? This especially makes no sense when you consider that there is also little understanding of how individual nutrient-dense foods fit into healthful dietary patterns. To advance the public's understanding of what constitutes a nutrient-dense food, nutrient profiling must necessarily be algorithmically independent from the Healthy Eating Index and USDA dietary guidelines. Only then can we use nutrient profiling to improve dietary guidelines.

It makes vastly more sense to devise a nutrient profiling method that simply reflects the nutritive value of a food, and then to study how eating more nutrient-dense foods impacts disease risk. In fact, there was a 2104 study of people over the age of 55 that showed that the higher the NRF9 of their diet as a whole, the lower their risk of all-cause mortality—the highest NRF9 quartile had a 16% lower chance of dying than the lowest NRF9 quartile. This study helps to prove that potentially huge health benefit of a diet replete with nutrient-dense foods, but more studies like this that incorporate even more nutrients into the calculus are necessary to advance this field of research.

Some scores penalize for the presence of nutrients whose excess consumption have been linked to health problems, like sodium, saturated fat, added sugars, and cholesterol. As we've already discussed, dietary cholesterol does not increase serum lipids for most people and is the backbone of vitamin D and

other steroid hormones. Dietary saturated fat is only problematic when intake exceeds about 10% of total calories (although this does depend on genetic predisposition, and there is mixed data on whether saturated fat needs to be limited for people without risk genes). Sodium is only problematic when intake exceeds about 7 grams per day, and there are studies showing that even this level is only worrisome when potassium intake is concomitantly low. Added sugars become problematic above about 10% of total calories (and 25% of total carbohydrates). Most importantly, all of these nutrients are healthy in moderate amounts, and only unhealthy when the whole diet includes excess. And, all of these potentially problematic nutrients are abundant in fast food, junk food and other hyperpalatable manufactured foods that are also low in essential nutrients and very high in calories—this is why scores that penalize for these nutrients give these types of foods scores less than zero! Penalizing individual foods for the presence of these nutrients does not reflect the diet as a whole, and has the capacity to undervalue otherwise nutrient-dense whole foods which can fit into a health-promoting diet, while not being necessary to show that fast food and junk food are unhealthy.

Another topic for discussion is whether to weight certain nutrients more in nutrient profiling. It makes sense on the surface to count those nutrients for which a larger proportion of the population are deficient more than those nutrients for which very few people are deficient. But, here's the challenge with that logic: the potential for overcorrection and simply shifting towards different common nutrient deficiencies. If those foods that are particularly good sources of the nutrients that, for example, an estimated 70% or more of Americans routinely don't consume enough of (vitamin B9, vitamin D, vitamin E, choline, calcium, potassium, zinc, omega-3 fats, and polyphenols) had inflated scores as a result of weighting these nutrients more heavily in nutrient profiling, food sources of other nutrients end up being undervalued. This approach has the capacity to shift food choices in a way that could help address some population level nutrient deficiencies over the short term, but that's not the same thing as moving towards nutrient sufficiency, especially over the long term. I would also argue that dividing the amount of a nutrient in a food by its percent daily value already puts it into the context of how much to body needs.

None of the nutrient profiling methods described thus far in the scientific literature have been adopted by any institution or agency. Why? They're just not ready for primetime.

When you look at how foods stack up using these various nutrient density scores, the results don't quite add up. When the NNR of 120 foods was compared to the average healthiness ratings from over 700 registered dietitians, nutritionists, and other health professionals, there was only 62% agreement. That means that, for 38% of foods, the NNR showed that the food was healthy whereas health professionals disagreed, or the other way around. Certainly, some of this difference can be explained by the unearned reputation of some foods swaying the scores given by the health professionals, but the bigger issue is that the NNR uses only fourteen nutrients in its calculation. When the quality of people's diets was evaluated using the NRF compared to the Healthy Eating Index, did not align particularly well—the NRF only explained 44.5% of the variance in the Healthy Eating Index. The most complex algorithmically of the nutrient profiling systems is the Food Compass, which incorporates 54 food attributes into its calculation,

including assessing things like additives and processing. However, the Food Compass has been criticized because it weighs certain attributes more heavily, which skews the results towards plant foods in a way that doesn't reflect the current scientific literature—for example, Lucky Charms cereal scores twice as high as ground beef or cheddar cheese, and a boiled egg scores the same as pineapple canned in heavy syrup.

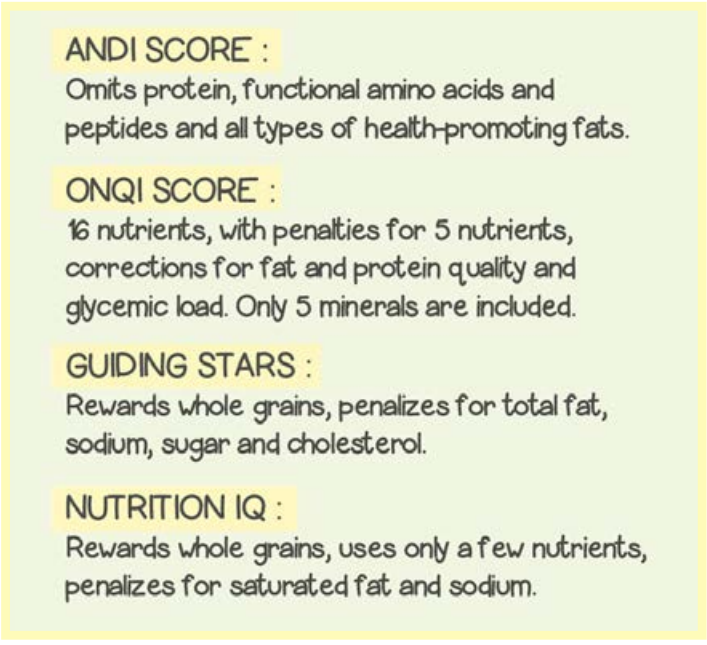
Several other nutrient profiling methods have been devised by non-researchers with the goal of educating consumers, such as the ANDI Score, NuVal (based on ONQI), Guiding Stars, and Nutrition IQ.

The ANDI score may be one of the most comprehensive nutrient profiling systems, but the score overemphasizes nutrients inherent to plant foods while deemphasizing nutrients inherent to animal foods, creating a biased result. For example, the ANDI score incorporates separately into its calculation: beta carotene, alpha carotene, lycopene, lutein and zeaxanthin (all carotenoids); fiber and resistant starch (both fiber); glucosinolates and organosulfides (both organosulfur compounds); phytosterols, angiogenesis inhibitors, aromatase inhibitors, resveratrol and ORAC score (most plant phytonutrients are antioxidants as are vitamin C and E). On the other hand, the score omits protein and all types of health-promoting fats.

The ONQI is calculated based on 16 nutrients, with penalties for 5 nutrients, and corrections for fat and protein quality and glycemic load. Most notably, only 5 minerals are included, only three of the B vitamins are included, and only two types of phytonutrients (flavonoids and carotenoids) are included, while vitamin K and choline are excluded. In addition, because cholesterol is penalized and saturated fat is penalized (despite saturated fat only being problematic when intake is higher than about 15% of total calories), animal foods are penalized unnecessarily.

The Guiding Stars system rewards whole grains (despite their low nutrient-density compared to vegetables, fruits, legumes, nuts and seeds), and penalizes for total fat, sodium, sugar and cholesterol. And the Nutrition IQ system also rewards whole grains, uses only a few nutrients in its determination, and also penalizes for saturated fat and sodium. The net result for both of these scores is to overemphasize grains, which are not nutrient-dense by any objective measure, and deemphasize animal foods.

When we look at nutrient profiling methods described in the scientific literature, it becomes abundantly clear that a nutrient-density score best describes a food when it includes as many nutrients as possible, when the contribution of nutrients are not capped, when they the score is calculated relative to calories, when they are not weighted by food



groups, and when they are not normalized to a fixed scale. That's what the Nutrivore Score algorithmically accomplishes!

Before sharing exactly how the Nutrivore Score is calculated, there's one final challenge to nutrient profiling that applies equally to the Nutrivore Score that is worth discussing: incomplete data. The United States Department of Agriculture maintains arguably the most comprehensive nutrient database in the world, called Food Central, with expanded nutrient data compiled for over 7,000 basic foods and partial nutrient data (at least what is required on food label) for nearly 360,000 different branded foods. But even this amazing database is missing some key information. Many of the main entries are missing measurements for some nutrients (commonly vitamin D, vitamin B5, manganese, vitamin K2, and phytosterols) and certain nutrients aren't included in the database at all (including vitamin B7, iodine, polyphenols, CoQ10, and other functional compounds, including most phytonutrients). Fiber is not differentiated between soluble and insoluble, and the method used to measure fiber is known to undercount resistant starch and oligosaccharides. In addition, the entries generally provide average measurements for common quality food products, so it's not possible to differentiate the nutrient content of higher-quality options. And, while many of these gaps can be filled in from measurements presented in scientific studies, it's surprising to discover how incomplete human knowledge is about the nutrient content of common foods. There's really no good solution, other than to scour the scientific literature for as many nutrients as possible missing from the USDA Food Central database which is what Team Nutrivore has done, label when a nutrient-density score is calculated based on incomplete data as is the case for the entire Nutrivore Score database, and advocate for continued measurements of the nutrient content of foods.

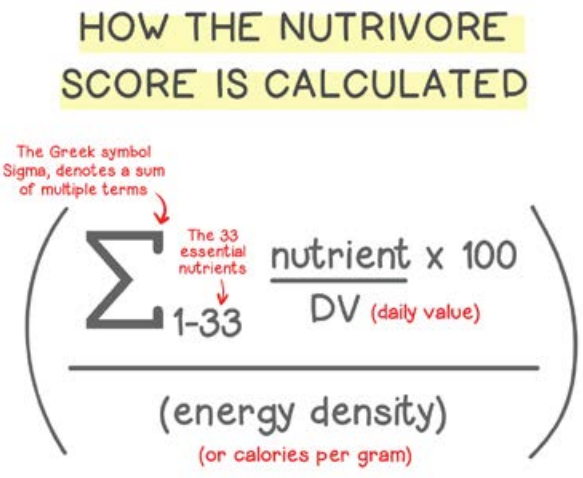
How the Nutrivore Score Is Calculated

The Nutrivore Score is currently the most comprehensive, and least bias, method for representing the inherent nutrient content of foods. It was borne out of a confusing array of similar, yet all flawed, nutrient density scores, while recognizing the current limitations posed by incomplete data.

> The Nutrivore score is calculated based on 32+1 nutrients. The 32 primary nutrients that go into the score are:

- PROTEIN
- FIBER
- CALCIUM
- COPPER
- IRON
- MAGNESIUM
- MANGANESE
- PHOSPHOROUS
- POTASSIUM
- SELENIUM
- ZINC
- VITAMIN A
- VITAMIN B1
- VITAMIN B2
- VITAMIN B3
- VITAMIN B5
- VITAMIN B6
- VITAMIN B7
- VITAMIN B9
- VITAMIN B12
- VITAMIN C
- VITAMIN E
- VITAMIN D
- VITAMIN K
- CHOLINE
- MONOUNSATURATED FAT
- LINOLEIC ACID
- ALA
- EPA+DHA
- CAROTENOIDS
- PHYTOSTEROLS
- POLYPHENOLS

The score is calculated as the sum of each nutrient relative to its RDA or AI present in 100 grams of the food, divided by the amount of calories per 100 grams. Data that's not included in the Food Central Database are obtained from scientific papers and other databases like Phenol Explorer whenever possible. When multiple papers report the amount of a nutrient for a particular food, the highest value is utilized, unless there's a clear methodological advantage to one specific measurement, and provided it is no more than one standard deviation from the mean of all available data (in which case, the second highest value is utilized following the same statistical test). Also, periodically two entries from the Food Data Central database are amalgamated to calculate the Nutrivore Score when two highly-related foods (for example, sockeye salmon and coho salmon) have incomplete data. This is noted wherever it's the case.



Further, the Nutrivore Score adds the highest value of available data for one bonus nutrient (that's the +1), relative to a threshold set using epidemiological studies for that nutrient, similar to a %DV. The bonus nutrient currently can be any of: glucosinolates (the precursor for isothiocyanates and indoles), thiosulfinates, CoQ10,

CLA, betaine, betalains, myo-inositol, ergothioneine, taurine and medium-chain triglycerides. The reason why only one bonus nutrient is included in the Nutrivore Score is because incomplete data would mean less common foods are unnecessarily penalized.

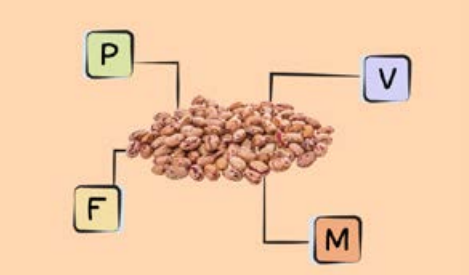
The Nutrivore Score is not corrected for nutrient bioavailability, nutrient absorption capacity, or metabolic conversion inefficiencies. It's true that specific isoforms of nutrients are more easily absorbed and/or used by the body. For example, while vitamin K1 accounts for approximately 90% of the total vitamin K in the diet, only 10% to 15% of it is absorbed in the digestive tract. The net effect is that vitamin K1 accounts for about half of the total absorbed vitamin K, whereas vitamin K2 is highly absorbable and represents the remaining 50%. While vitamin K isoform data is available for some foods in the USDA Food Central database, as a general rule, nutrient isoform data is rarely available, making correcting for absorption or utilization efficiency of different nutrient forms impossible. It's also true that certain combinations of nutrients can either enhance or hinder absorption. For example, vitamin C can increase iron absorption, fats can increase carotenoid and vitamin K absorption, but zinc and copper compete for absorption as do calcium and magnesium. However, this can't be accounted for in a nutrient density score for an individual food because all nutrients present in an entire meal interact. And sometimes, absorption is influenced by factors independent of food. For example, vitamin D status influences calcium absorption; a functioning gallbladder is necessary for efficient fat and fat-soluble vitamin absorption; and while folic acid is much more readily absorbed in the digestive tract than the active form of vitamin B9, L-methylfolate, those with certain MTHFR gene variants can't covert folic acid efficiently. So, because nutrient absorption competition or facilitation goes beyond an individual food and is instead related to all of the foods consumed at a meal as well as other factors such as genetics, it makes no sense to correct for these in a nutrient profiling method. The Nutrivore Score also does not incorporate a satiety index, again because satiety is related to macronutrient and water combinations from an entire meal rather than an individual food.

Because nutrients can be lost, formed and transformed by cooking, the Nutrivore Score is calculated based on the nutrients within the raw whole food, unless noted otherwise. Also, it is unusual for there to be nutrient data for different quality levels of a food. For example, the Food Central database contains only one entry for olive oil, but research has shown that the polyphenol content of virgin olive oil can range from anywhere between 50 to 5000 mg/kg, and the vitamin E content can range form 100 to over 1000 mg/kg. As another example, even though locally-grown, in-season organic vegetables are fruit and known to have higher nutrient density (due to being grown in higher quality soil, picked ripe, and eaten much sooner after harvest), there are no separate entries in the Food Central database for organic versus conventionally-grown produce. For this reason, we can think of Nutrivore Scores as a minimum or average value and feel confident

that the effort to seek out higher quality options (grass-fed meat, wild-caught fish, fresh cold-pressed extra-virgin olive oil, and local in-season vegetables and fruit) is still nutritionally valuable if currently not quantifiable.

Rather than penalizing for the presence of nutrients whose excess is associated with health problems (like saturated fats, sodium and sugars), these nutrients are simply not included in the Nutrivore Score calculation. It is helpful to note that foods high in fats and sugars have a higher energy density, meaning more calories per gram or per serving of food, which does lower the Nutrivore Score. In addition, the presence of antinutrients such as phytates or oxalates are not taken into account. This is because the impact of antinutrients on nutrient absorption is extremely context dependent. For example, our gut bacteria can liberate a substantial amount of the calcium, magnesium, iron, potassium and zinc bound to phytates for us, thereby releasing the bound minerals as well as phosphorus and thereby enhancing their bioavailability. A healthy, diverse gut microbiome can typically degrade about half (about 500 to 600 mg daily) of the phytate consumed in the average American diet. Other factors influencing bioavailability include health of the gastrointestinal tract, nutrient status, competitive binding with other nutrients, meal composition, various drugs and supplements, time of day and biorhythms, age and gender. It doesn't make sense to try to reflect nutrient digestibility and absorption in the Nutrivore Score when the system is so complex and varies from individual to individual.

When the amount within a specific food of multiple nutrients remains unknown, the food's Nutrivore Score is marked with a footnote. When nutrient data is missing, the calculated Nutrivore Score is lower than what it should be and we can think of the Nutrivore Score as a minimum. However, the more data that is unavailable, the more unreliable the Nutrivore Score is; so, these footnotes denote how much data is missing: 10% to 25%, 25% to 50%, or more than 50%. On the flip side, there are food ingredients that can inflate a Nutrivore Score, including fortification ingredients and non-nutritive sweeteners and fats. Adding vitamins or minerals to a food increases the value of those nutrients in the Nutrivore Score calculation, regardless of the bioavailability of those added nutrients, so fortified foods are also marked with a footnote. When non-nutritive sweeteners or fats are used, the energy density is decreased, which then increases the Nutrivore Score — given that there's typically a health tradeoff with non-nutritive sweeteners and fats, these Nutrivore Scores are also marked with a footnote. And finally, it is impossible to calculate the Nutrivore Score of non-caloric foods, such as salt or baking soda, because the calculation doesn't work if you divide by zero. These foods are also marked with a footnote.



Nutrivore Score: 265[1]

[1]Nutrivore Score may be higher since 10 to 25% of data is missing.

As more nutrient data become available, the Nutrivore Score will be updated to reflect more complete nutritional information. This obviously applies to missing nutrition information from the Food Central database, but there's also the likelihood of adding nutrients to the Nutrivore Score calculation in the

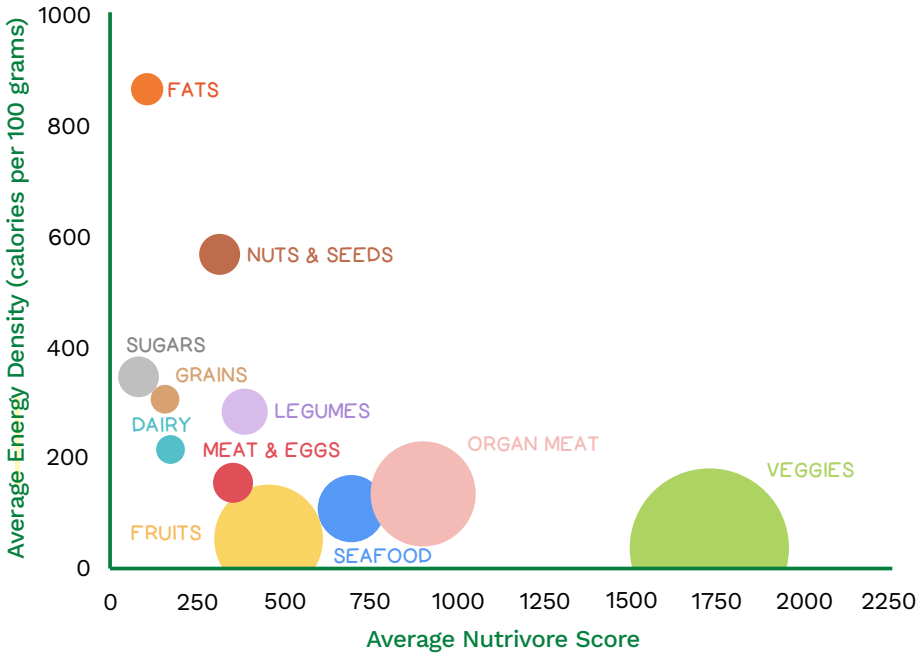
future. For example, a protein digestibility score, soluble versus insoluble fiber, trace minerals, functional nonproteinogenic amino acids and peptides, functional fatty acids, and vitamin-like compounds that aren't currently utilized to calculate the Nutrivore Score (or are only utilized as the bonus nutrient) could all be added once there is sufficient data to rationalize their inclusion. For now, extremely sparse data makes this prohibitive, and similarly would reward foods simply for being better studied, not necessarily for inherently higher nutritional value, relative to less common foods.

It is time for a positive approach to dietary guidance using nutrient density as a basic principle. The Nutrivore Score is a necessary foundational step towards achieving this goal! By understanding the nutrients per calorie offered by individual foods via the Nutrivore Score, in addition to the recognition that certain nutrients are exclusive to specific food groups, we can achieve nutrient sufficiency by choosing a variety of nutrient-dense superfoods as well as the highest Nutrivore Score options from the various foundational food groups. We'll cover what Nutrivore looks like in practice in more detail!

Food Groups by Nutrivore Score

The first way to use the Nutrivore Score is to identify nutrient-dense eating patterns. In fact, we can glean a ton of insight on how best to approach a Nutrivore diet by examining nutrient versus caloric contributions of various food groups to our diets. To do this, we're going to take a more granular approach to food groups—instead of the four or five that you're used to, we'll consider a few dozen more highly related collections of foods—let's call them food families to differentiate from how food groups are usually defined.

While all whole and minimally-processed foods are nutritious options, some do offer more nutrients than others. The following graph shows the average nutrient density, as represented by the Nutrivore Score, of food families on the x-axis, with energy density (calories per 100 grams) on the y-axis. The size of each food family is representative of the variability in nutrient density within that food group (the size is half of a standard deviation of the Nutrivore Scores).



What does this graph tell us? Well, the farther to the right, the more nutrient-dense a food is, and the higher up, the more calories it has per gram. So vegetables, being far to the right and also very low, are foods that offer a ton of nutrients and not very many calories, which helps to emphasize the importance of a vegetable-forward approach to the overall diet. On the opposite side of the spectrum, fats are high-calorie and don't deliver a ton of nutrients per calorie. This doesn't mean that fats are bad, and as we've already covered, there are many that are extremely health-promoting. Instead, it gives you a sense of the proportions of these foods to eat, relative to each other, vegetables in abundance and fats in more moderate amounts. Indeed, high vegetable consumption is one of the most important eating patterns for lifelong health, and supported by a wealth of scientific research.

There's some other interesting insight to glean from this graph. For starters, organ meat and seafood are the clear winners in terms of protein foods—many of them rival the most nutritionally impressive vegetables in terms of nutrient density despite the fact that they are more energy dense. In fact, organ meat and shellfish deliver the highest amount of nutrients per serving of any food! Indeed, of all animal foods, seafood is the most consistently associated with improved health outcomes in the scientific literature. In contrast, dairy has the lowest average nutrient density of the protein foods. Again, this doesn't mean that we need to avoid dairy—it's our most concentrated food source of calcium after all—but rather emphasizes that it would be best not to rely solely on dairy products as our protein food, since that would contribute much less nutrients to the total diet than if we vary our protein sources more and include some organ meat and seafood.

Another interesting revelation from this graph is that grains have the lowest nutrient density among starchy foods and are only second to nuts and seeds in terms of caloric density of whole foods—we would get a lot more nutrition if we swapped at least some servings of grains for other starchy foods like legumes, root vegetables and winter squash. Again, this doesn't mean we need to avoid grains—whole grains do have a great track record for improving health outcomes in the scientific literature—but rather, that it's important to make sure excess grain servings aren't displacing more nutrient-dense options like vegetables and legumes.

It's also easy to see that adding sugars and fats to a recipe or meal tends to add a lot of calories and but not much in the way of valuable nutrition, so they are best used with that in mind. But, I will once again emphasize that there are no "yes foods" and "no foods" with a Nutrivore approach. Even a brief look at the Nutrivore Scores included in this e-book make it clear that foods fall along a spectrum and delineating between high or low nutrient-density is subjective. Plus, few foods are truly empty calories (white sugar definitely qualifies with its low, low Nutrivore Score of 1). And, even the emptiest of calories can have a place in a diet dominated by nutrient-dense foods since the goal is nutrient sufficiency of the whole diet rather than setting a threshold for each individual ingredient in a meal.

Looking at the average nutrient density of food families

is also a great way to implement a Nutrivore diet without sweating the details of each food's Nutrivore Score. The following table shows the average Nutrivore Score and energy density (calories per 100 grams) of all of the whole-food families. You can use this table as a rough guide when choosing foods, to narrow in on the most nutrient-dense option that makes sense with the meal you're preparing.

A Nutrivore approach is inherently flexible, and the more nutrient-dense foods we choose, the more flexibility there is for incorporating quality-of-life foods in our diet.

Food Subgroup Average Nutrivore Scores

	Average Nutrivore Score	Average Calories per 100g
VEGETABLES	1732	44
Crucifers	3740	32
Leafy Vegetables	3476	25
Mushrooms	2704	29
Alliums	2142	56
Parsley Family	1422	40
Sea Vegetables	1036	36
Nightshades	812	40
Other Vegetables	744	58
Root Veggies	701	74
Winter Squash	503	36
High-Starch Veggies	290	93
FRUITS	457	61
Berries	489	53
Tropical & Subtropical Fruit	406	72
Citrus	391	51
Melons	307	34
Rosaceae Family	244	61
Stone Fruits	294	48
Apple Family	204	60
Fatty Fruit	201	264
SEASONINGS	1080	256
Fresh Herbs	2003	57
Spices	796	335

TEA & COFFEE	4309	2
NUTS & SEEDS	276	575
Seeds	374	545
Nuts	294	594
LEGUMES	389	283
Fresh Legumes	580	55
Pulses	358	307
Peanuts	219	568
GRAINS	156	307
Pseudograins	297	392
Whole Grains	189	306
Refined Grains	81	310
SEAFOOD	695	108
Shellfish	925	87
Fish	602	119
OFFAL	680	170
Organ Meat	903	133
Bone Broth & Stock	490	20
MEAT & EGGS	352	155
Eggs	373	168
Red Meat	360	159
Poultry	343	149
DAIRY	149	257
Milk	218	66
Cheese	140	331
Milk Alternatives	320	143
FATS & OILS	102	860
SUGARS	76	354

Using the Nutrivore Score for Swaps and Additions

> The most important thing to know is that eating a Nutrivore diet cannot be distilled down to simply always choosing the highest Nutrivore Score foods.

That's because even the most nutrient-dense food is not nutritionally complete. In fact, there's no such thing as a nutritionally complete food for human biology. Instead, the Nutrivore Score is a guide to help you identify the most nutrient-dense options, make better choices, and find creative ways to increase the nutrition of a meal. The best way to use the Nutrivore Score is to identify the most nutrient-dense option within the foods you like, have access to, and can afford, with either a swap strategy or an addition strategy.

In terms of swapping, think about higher Nutrivore Score foods that are interchangeable in the meal you are planning. For example, let's say you're planning on roasting chicken for dinner, and want to serve it with something starchy and some kind of steamed vegetable. Instead of a dinner roll (with a Nutrivore Score of 130), consider a baked sweet potato (Nutrivore Score of 497) or butternut squash (Nutrivore Score of 718). And, instead of steaming green beans (Nutrivore Score of 605), swap them out for asparagus (Nutrivore Score of 1385) or broccoli (Nutrivore Score of 2833). Making spaghetti? Instead of regular pasta noodles (Nutrivore Score of 145), consider whole wheat pasta (Nutrivore Score of 202); options made with edamame, chickpeas or lentils (Nutrivore Scores up to 509); zoodles (a.k.a. zucchini noodles; Nutrivore Score of 1477); or baked spaghetti squash (Nutrivore Score of 297).

Any time you can swap out a lower Nutrivore Score food or ingredient for a higher one, you're upping your overall nutrient intake (at least, when you are consuming roughly comparable calories worth of that food). You can apply this to your choice of breakfast cereals, pizza toppings, snack foods, salad dressings, sandwich fixings, barbecue side dishes... everything you eat!

Another great strategy to up the nutrient density of your meals is to add foods, like vegetables and herbs, that contribute more nutrients to your meal. For example, let's say you add one tablespoon of chopped garlic (about 3 cloves), which has a Nutrivore Score of 5622, and a half cup of chopped fresh basil, which has a Nutrivore Score of 3381, to an entire 40-ounce jar of store-bought marinara sauce to liven it up—that would boost the Nutrivore Score of your spaghetti sauce from 575 to 707! And, many condiments are very nutrient-dense. For example, hot sauce has a Nutrivore Score of 1193, mustard has a Nutrivore Score of 718, fish sauce has a Nutrivore Score of 593, and soy sauce has a Nutrivore Score of 433. You also can't go wrong by adding a serving of berries to your breakfast, veggies and dip or hummus to your lunch, or a side salad to your dinner.

There is a caveat when it comes to the Nutrivore Score. If you find yourself obsessing over nutrient density gamification, or finagling high-Nutrivore Score swaps or additions in a way that detracts from your enjoyment of the foods you're eating, then I want you to disregard the Nutrivore Score completely. The Nutrivore Score is a super-useful tool, but not every tool works for every person. Instead, work on the essential Nutrivore eating patterns, and using the Nutrivore Meal Map.

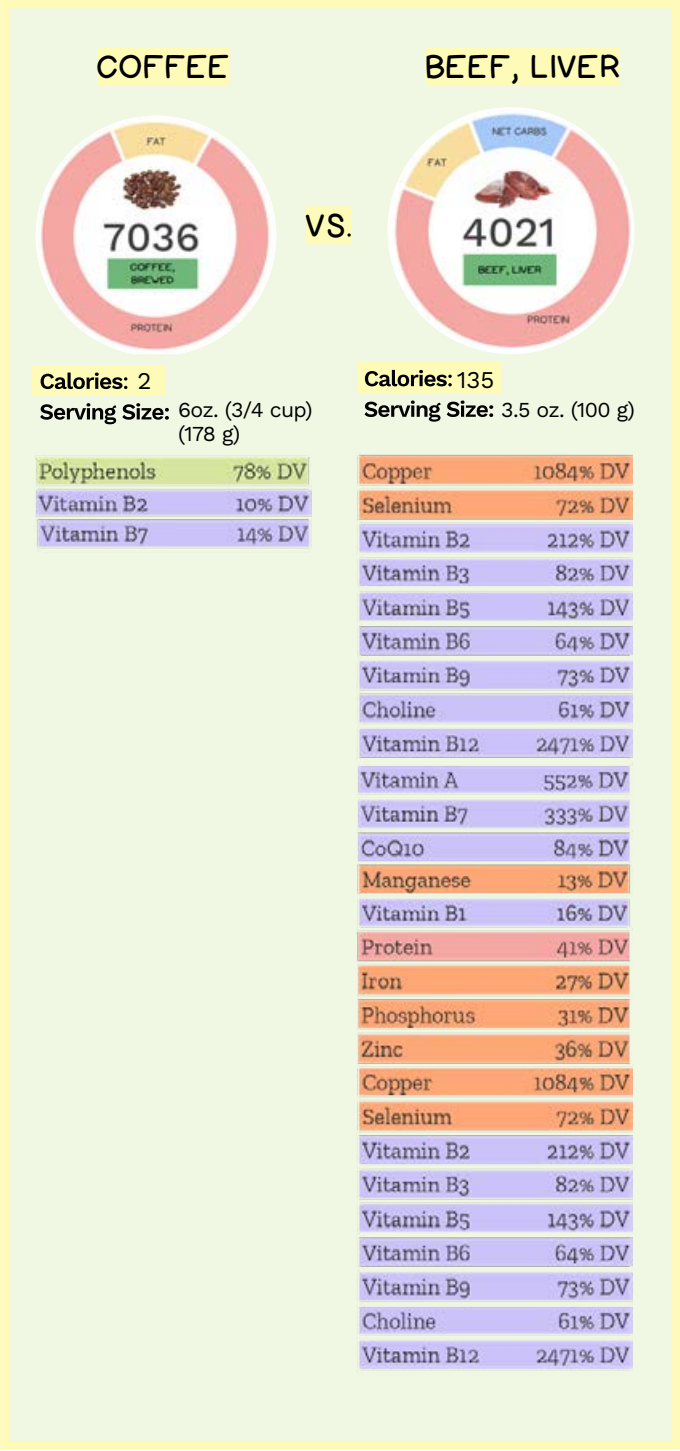
The 100 Highest Nutrivore Score Foods

Currently, over 700 Nutrivore Scores for whole foods and whole-food based ingredients have been calculated (a subset of an expanded database of over 7500 foods).

> These scores represent the nutrients provided per calorie rather than per serving or per gram of food.

So, it's also helpful to think about how much of a particular food you might consume and its caloric contribution to your diet in addition to its nutrient density. For example, black coffee has one of the highest Nutrivore Scores at 7036 thanks to containing large amount of polyphenols and small amounts of minerals and B vitamins while having extremely low caloric density, just 2 calories per cup! But, a cup of coffee itself is only a good source (10% to 20% DV) of just 2 nutrients—vitamin B2 vitamin B7—and a best source (>50% DV) of just one nutrient: polyphenols. On the other hand, liver has an extremely high Nutrivore Score (from 4925 for lamb liver to 2483 for pork liver) thanks to containing huge amounts of vitamins and minerals with moderate caloric density at 135 calories per 3.5-ounce serving. A serving of beef liver is an excellent source (20% DV or more) of protein, iron, phosphorous, zinc, copper, selenium, vitamin B2, vitamin B3, vitamin B5, vitamin B6, biotin, vitamin B9, vitamin B12, choline, vitamin A, and coQ10 and is a good source of vitamin B1 and manganese. While both coffee and liver are super nutrient-dense, they don't contribute equally to the overall diet because of their energy density and size of a typical serving.

Here are the top 100 Nutrivore Score foods that you can find most times of year and at most grocery stores. Their detailed nutrient cards which show nutrients per serving in addition to Nutrivore Score are also included in this e-book.



The 100 Highest Nutrivore Score Foods You Can Get at the Grocery Store

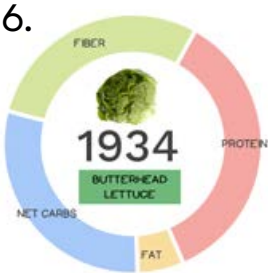
*REPRESENTS AN AVERAGE OF FOODS

Food	Nutrivore Score
*Coffee	6832
*Chard	6386
Radishes	5863
Garlic	5622
Parsley	5491
*Southern Style Greens	5028
Spinach	4548
Shiitake mushroom	4343
Kale	4233
*Tea	3721
*Liver	3692
Chives	3531
Bok choy *(AKA Pak Choy, Chinese Cabbage)*	3428
Basil	3381
Curly Endive *(AKA Chicory greens)*	3086
Broccoli	2833
Brussels sprouts	2817
Red leaf lettuce	2684
*Oysters	2652
Cilantro *(AKA Coriander leaves)*	2609
Oyster mushroom	2550
Kohlrabi	2497
*Kidney	2484
Radicchio	2471
Endive *(AKA Belgian endive, Chicory spear)*	2390
Chinese Broccoli *(AKA Chinese Kale, Gai lan)*	2365[1]
Crimini mushroom *(AKA Brown mushroom, Italian brown mushroom, Baby Bella)*	2279
Green leaf lettuce	2245
Romaine lettuce *(AKA Cos Lettuce)*	2128
Green Onions	2097
Arugula *(AKA Rocket)*	2019
Cabbage, green	2018
Beets	2013
Turnip	1954
Dill weed	1940
Butterhead lettuce *(AKA Boston lettuce, Bibb lettuce)*	1934
White button mushroom	1872
Octopus	1618
Summer squash	1596
Cauliflower	1585
Mussels	1564
Laver *(AKA Nori)*	1520
*Tomatoes	1501
Portabella mushroom	1483
Zucchini	1477
Asparagus	1385
Cabbage, red	1369
*Peppers, sweet *(AKA Bell peppers)*	1226
Leeks	1128
*Crab	1114
*Peppers, hot chili	1111
Clams	1046
Pumpkin	1036
Cocoa, unsweetened	1024
Herring	996
*Mint	962[2]
Mackerel	922
*Kimchi / Sauerkraut	904
Alfalfa Sprouts	902
Carrots	899
Squid	890
*Heart	884[1]
Okra	859
Lobster	839
Anchovies	805
Iceberg lettuce	773
Artichokes	771
Celery	767
Rutabaga *(AKA Swede)*	766
Strawberries	762
*Tuna	752
Flatfish *(AKA Flounder, Sole)*	749
Blackberries	743
Shallots	740
*Salmon	731
Mung bean Sprouts	711
Pickles, sour	702
Brazil nuts	694
*Trout	678
Butternut squash	670
Edible-podded Peas	669
Fennel	663
Whitefish	663
Sardines *(canned in oil)*	654
Scallops	645
Papaya	636
Pears, Asian	621
Green Beans *(AKA Green snap beans)*	605
Eggplant *(AKA Aubergine)*	563
Catfish, wild	559
Swordfish	557
Snapper	548
Persimmons, Japanese *(AKA Kaki Fruit)*	537
Shrimp	535
Halibut	523
Plums	521
Flaxseed *(AKA Linseed)*	515
Raspberries	491
Lentils	489
*Kiwi	477

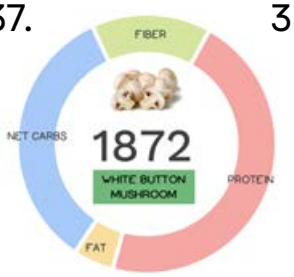
[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
* *Average of representative foods.*

The 100 Highest Nutrivore Score Foods You Can Get at the Grocery Store

36.



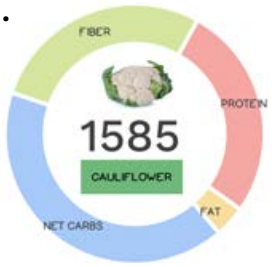
37.



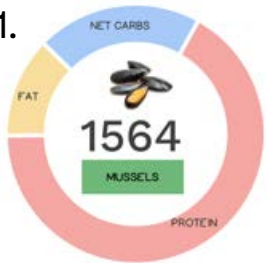
38.

39.

40.



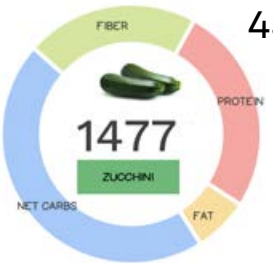
41.



42

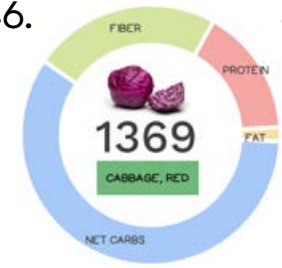
43.

44.

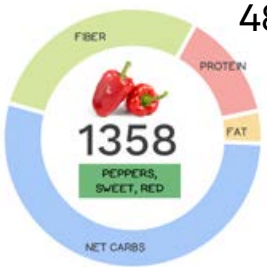


45.

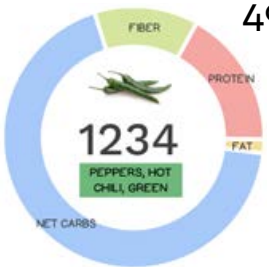
46.



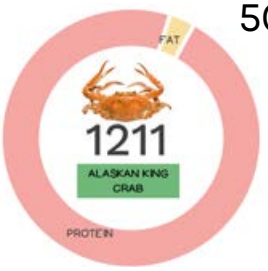
47.



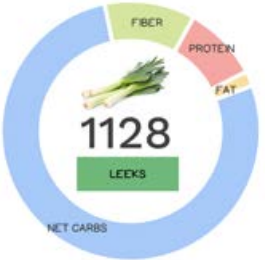
48.



49.

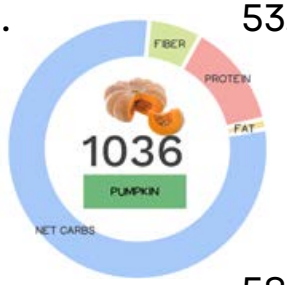


50.



51.

52.

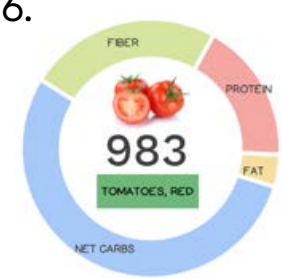


53.

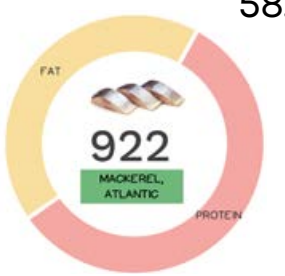
54.

55.

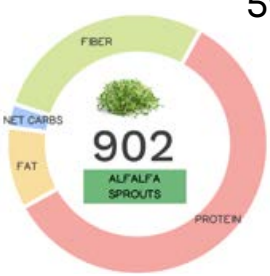
56.



57.



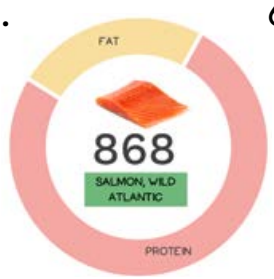
58.



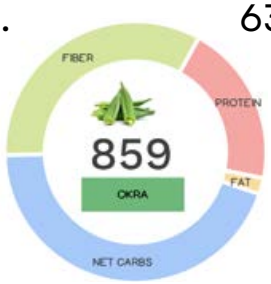
59.

60.

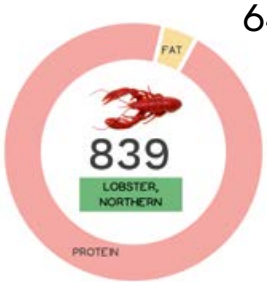
61.



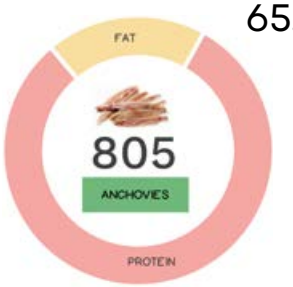
62.



63.

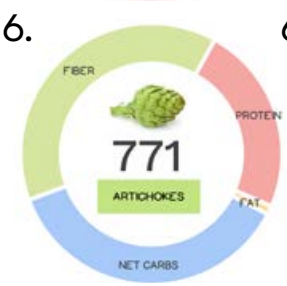


64.



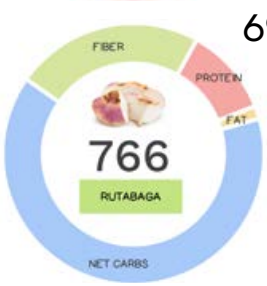
65.

66.

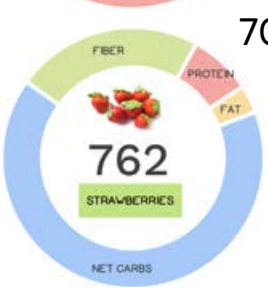


67.

68.

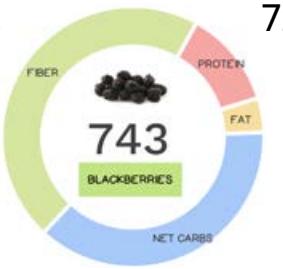


69.

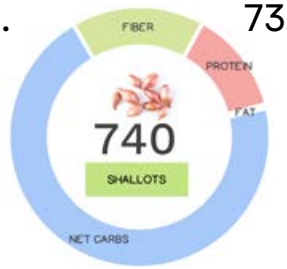


70.

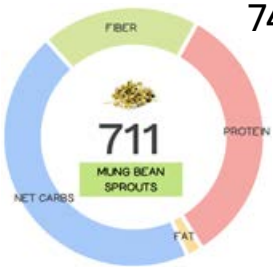
71.



72.



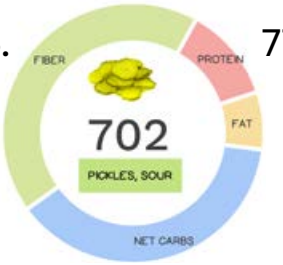
73.



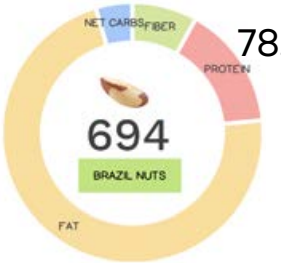
74.

75.

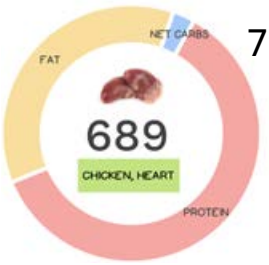
76.



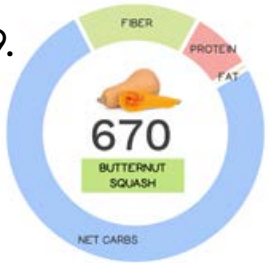
77.



78.

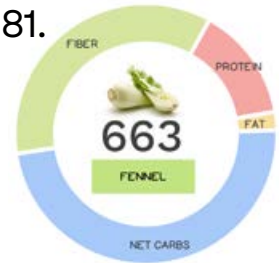


79.



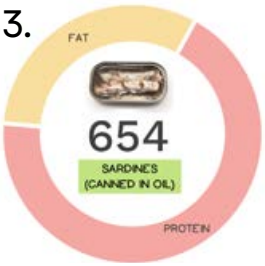
80.

81.

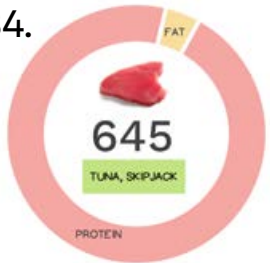


82.

83.

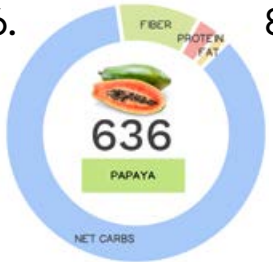


84.

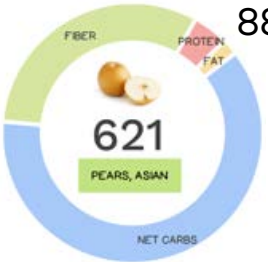


85.

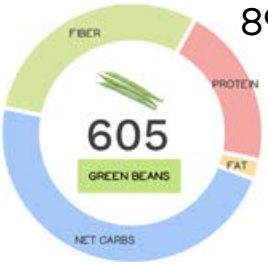
86.



87.



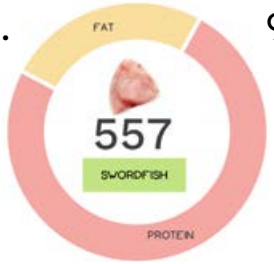
88.



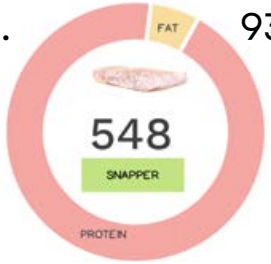
89.

90.

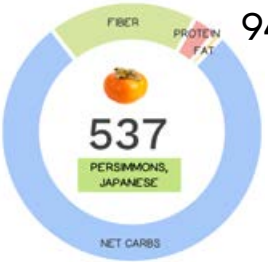
91.



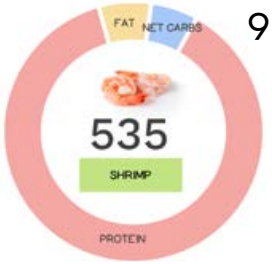
92.



93.

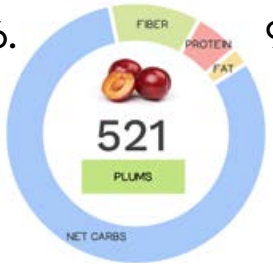


94.

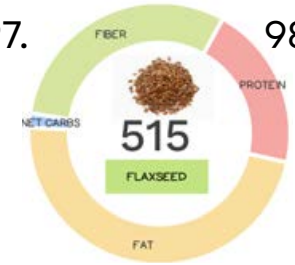


95.

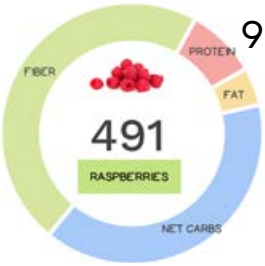
96.



97.

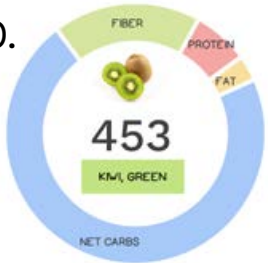


98.



99.

100.



Nutrivore in Practice

We've covered what nutrients are, what they do in the human body, how much we need, and how little of us are getting enough. And, we've talked about how the Nutrivore Score is the most comprehensive and least biased assessment of the nutrient density of individual foods, acknowledging that the nutrient data for many foods is incomplete. We've analyzed the average nutrient density of food families and discussed how to use the Nutrivore Score in practice to identify sensible and realistic swaps and additions to up the nutrients in your meals.

So, let's wrap up by talking much more about Nutrivore in practice, and how we can make decisions based on nutrients to ensure that we get ample quantities of every nutrient to support our overall health. In this section, we'll take a broader view of the overall diet, identify the 12 Nutrivore foundational food families, and the four most important Nutrivore eating patterns that support lifelong health.

A NUTRIVORE DIET INCLUDES A LARGE VARIETY OF PLANT FOODS AND ANIMAL FOODS

Nutrivore Foundational Foods

Foods benefit our health by supplying us with nutrients our bodies can use as biological constituents or for biological processes. Foods that supply a wide range of important nutrients, or alternatively, a large amount of a nutrient that's harder to get, quantitatively improve health, for example, by reducing risk of chronic disease. When determining which foods form the foundation of Nutrivore, we first look at what nutrients those foods contain that are hard or impossible to get from other sources. Then we look at the vast variety of studies evaluating how varying intake levels of those foods impact health outcomes, the most relevant of which is all-cause mortality, but also cardiovascular disease and risk factors, cancer prevention, risk of developing and worsening type 2 diabetes, and risk of neurodegenerative disease.

THE NUTRITIONALLY-DISTINCT NUTRIVORE FOUNDATIONAL FOODS ARE:

vegetables in general

cruciferous vegetables (the cabbage family)

root vegetables

leafy vegetables

mushrooms

alliums (the onion family)

fruit in general

citrus fruits

berries

pulse legumes

nuts and seeds

seafood

These food families each have something uniquely beneficial to offer us and we maximize both our nutrient density and health benefits when we focus on these foods as the foundation of our diet.

But this does not mean these are the only foods to eat on Nutrivore; it just means that getting all of the nutrients your body needs from the foods you eat will be easiest when you prioritize these foods in your diet. You can then round out your diet with whatever other foods you choose. There are plenty of other food families with nutritional merit, they just aren't so amazing to be elevated to foundational food status.

Let's review the 12 Nutrivore foundational food families and the nutrients they deliver that earn them this status!

Vegetables

Vegetables are rich sources of diverse fiber types, a vast array of phytonutrients, vitamin C, vitamin K, manganese and copper, with many also being abundant in B-vitamins (especially B1, B5, B6, biotin and folate), potassium, and magnesium.

In general, aim for at least five servings of vegetables, and as much as you want above that amount. A serving is one cup for most raw vegetables and two cups for raw leafy veggies. Most vegetables will shrink to half a cup when cooked. You don't need to weigh or measure your veggie servings—approximations are just fine. And yes, your servings of cruciferous vegetables, root vegetables, leafy vegetables, mushrooms and alliums also count towards your five-plus servings of total vegetables.

If eating five or more servings of veggies feels intimidating, you're not alone! In fact, the average vegetable consumption is a mere 1.64 cup equivalents of vegetables per day, which is about one third of optimal intake. What's important to know is that every bit counts—you'll get way more health bang for your veggie serving buck going from zero to some than you will from going to quite a lot to even more—so it's okay to work up to that intake slowly over time.

Note that Nutrivore uses the culinary definition of a vegetable (i.e., savory applications in the kitchen) rather than the botanical definition (i.e., any plant part not derived from the ovary of a plant) because the culinary definitions better align with the nutrient profiles. So yes, you can think of tomatoes, cucumber, okra and avocadoes all as vegetables!

Select from as many different vegetable families as possible. In addition to the foundational food families specified below (cruciferous vegetables, alliums, mushrooms, root vegetables and leafy vegetables), other veggie families include:

- nightshades (e.g., tomatoes, peppers, potatoes, eggplant and chilis)
- beet family (e.g., beets, chard, amaranth, dragon fruit and prickly pear)
- parsley family (e.g., parsley, carrots, celery, fennel, dill, parsnips, and cilantro)
- sea vegetables (e.g., kombu kelp, nori kelp, arame, wakame)
- thistle family (e.g., artichoke and cardoons)
- ginger family (e.g., ginger, turmeric, and galangal)
- edible-podded legumes (e.g., snap peas, green beans, snow peas)
- summer squash (e.g., zucchini and pattypan squash)
- other veggies (e.g., asparagus, fiddleheads, sea beans, avocados, and olives)

Cruciferous Vegetables (The Cabbage Family)

Members of the cruciferous veggie family—like broccoli, Brussels sprouts, cabbage, and turnips—tend to be high in beneficial fiber types, vitamin C, vitamin K, biotin, folate, manganese, carotenoids, and polyphenols; but the super special nutrients they contain that elevate them to foundational foods status are glucosinolates.

The scientific literature makes a strong case for aiming for one serving of cruciferous vegetables daily—two is even better! A serving is one cup measured raw, and two cups for leafy cruciferous veggies like kale. Most cruciferous veggies will shrink to about half a cup when cooked.

Examples of cruciferous vegetables include:

- arugula
- bok choy
- broccoli
- Brussels sprouts
- cabbage
- cauliflower
- Chinese broccoli
- collard greens
- daikon
- horseradish
- kale
- kohlrabi
- mizuna
- mustard
- radish
- rutabaga
- tatsoi
- turnip
- wasabi
- watercress

Leafy Vegetables

Nutritionally, leafy greens have diverse nutrient profiles, but they all tend to be high in beneficial fiber types, folate, manganese, magnesium, carotenoids, polyphenols and vitamin K. While we technically can get all of these nutrients from other vegetables, leafy vegetables are our best sources, packing a ton of nutrients into a very low-calorie package, which is why they turn up as protective again and again in scientific studies.

Scientific studies make a strong case for a serving of leafy vegetables every day, and two servings daily would be even better! A serving is two cups measured raw, which shrinks to a third to half a cup when cooked.

Examples of leafy vegetables include:

- amaranth greens
- arugula
- beet greens
- chard
- collard greens
- cress
- dandelion
- endive
- kale
- komatsuna
- lettuce
- microgreens
- mizuna
- mustard greens
- pea leaves
- purslane
- radicchio
- sorrel
- spinach
- sprouts
- sweet potato leaves
- watercress

Root Vegetables

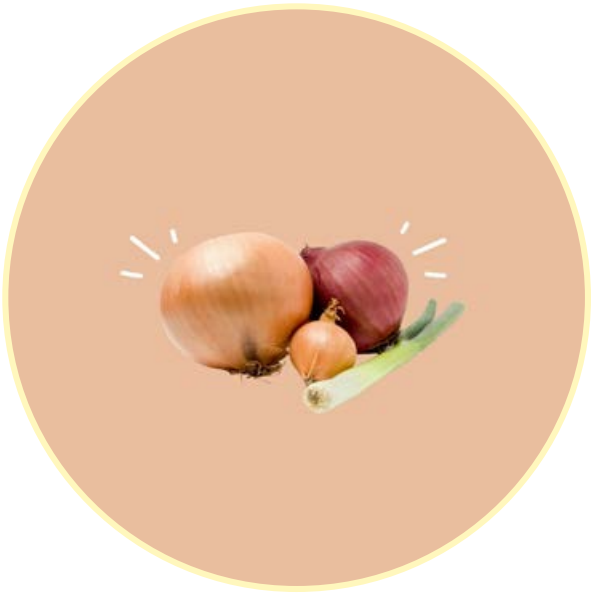
Root vegetables are any underground plant part consumed as vegetables, though not all of them are "true" roots. Botanically, bulbs like onions, corms like taro, rhizomes like ginger, and tubers like potatoes aren't actually roots, but in the Nutrivore and culinary worlds, they all count! Even winter squash, which are botanically fruit, are included in the root vegetable family because they are nutritionally and culinarily similar. Root vegetables tend to be rich in slow-burning carbohydrates, beneficial fiber types, B-vitamins (other than vitamin B12) and minerals, most notably copper, magnesium, manganese, phosphorus and potassium.

Scientific research makes a strong case for eating at least one serving of root vegetables daily. A serving of root vegetables is one cup, chopped and measured raw, which shrinks to about half a cup when cooked.

Examples of root vegetables include:

- acorn squash
- arrowroot
- bamboo shoot
- beet root
- butternut squash
- carrot
- cassava (aka tapioca, yuca)
- celeriac
- daikon
- delicata squash
- ginger
- Hubbard squash
- Jerusalem artichoke
- jicama
- kabocha squash
- lotus root
- parsnip
- potato
- pumpkin
- radish
- rutabaga
- spaghetti squash
- sweet potato
- taro
- tiger nut
- turnip
- water chestnut
- yam

Alliums (The Onion Family)



The onion family, also known as alliums, includes hundreds of different species belonging to the genus Allium, although the ones we're most likely to see on a dinner plate are onions, garlic, leeks, chives, scallions, and shallots. Nutritionally, alliums tend to be excellent sources of beneficial fiber types, vitamin B6, folate, vitamin C, vitamin K, manganese, potassium, copper, and iron. What's more, alliums boast a number of important phytonutrients—most notably their thiosulfinates which is the special thing they have that elevates them to foundational food status, but also carotenoids and polyphenols.

A strong case can be made based on the current scientific evidence for aiming for three servings of alliums per week, and a serving per day would be even better. A serving of garlic is one tablespoon, or about three cloves. A serving of chives is a quarter cup, chopped. A serving of all other alliums is one cup, chopped, measured raw, which shrinks to about half cup when cooked.

Examples of alliums include:

- chives
- elephant garlic
- garlic
- leek
- onion
- scallion
- spring onion
- shallot
- ramp

Mushrooms

Mushrooms aren't just superbly nutrient-dense, they also contain unique fiber types and phytonutrients that support our health in many ways but that we can't get in any other food; plus they are by far our best source of ergothioneine (also known as the longevity vitamin)! Mushrooms earn their foundational food status in multiple ways!

Scientific studies show that even a serving of mushrooms per week is beneficial, but from an ergothioneine perspective, aiming for three servings per week is a better target to get the longevity benefits of the longevity vitamin! Of course, there's no maximum amount of mushrooms to eat, so if you want to eat a serving or even two daily, go for it! A serving is one cup measured raw, and most mushrooms will shrink to about half cup when cooked.

Examples of mushrooms include:

- boletus
- button mushroom
- chanterelle
- cremini
- lion's mane
- maitake
- morel
- oyster mushroom
- portobello
- shiitake
- white mushroom
- wood ear mushroom

Fruits

Fruit are rich sources of diverse fiber types and a vast array of phytonutrients—complementary to those in vegetables—in addition to vitamin C and copper, with many also being a good source of B-vitamins (especially B1, B2, B5, B6, biotin and folate), vitamin K, manganese, magnesium, and potassium.

In general, aim for two or three servings of fruit per day. It's okay to eat more fruit than that, but this is the sweet spot for the most health benefit. A serving is one cup for raw fruits. Most fruits will shrink to about half a cup when cooked. And yes, your servings of citrus and berries also count towards total fruit.

Select from as many different fruit families as possible. In addition to the foundational food families specified below (citrus fruit and berries), other fruit families include:

- apple family (e.g., apples, pear, and quince)
- stone fruit (e.g., peaches, nectarines, plums and cherries)
- melons (e.g., watermelon, honeydew, cantaloupe, and casaba melon)
- tropical and subtropical fruit (e.g., mango, banana, kiwi, pineapple, and pomegranate)
- other fruit (e.g., grapes, pawpaw, persimmon)

Citrus

Citrus fruits offer a wide array of vitamins and minerals, but they're most valuable for their highly bioavailable vitamin C, carotenoids, polyphenols and beneficial fiber types—the combination of flavonoids, pectin fiber, and vitamin C is what elevates citrus fruits to foundational food status.

A strong case can be made based on the current scientific research for aiming for three servings per week of citrus fruits, and up to a serving or even two per day. A serving is one cup, raw, or a medium sized fruit.

Examples of citrus fruits include:

- blood orange
- Buddha's hand
- citron
- clementine
- grapefruit
- kaffir lime
- key lime
- kumquat
- lemon
- lime
- mandarin
- Meyer lemon
- orange
- pomelo
- tangerine

Berries

Nutritionally, berries truly stand out among the fruits thanks to their awesome polyphenol content, especially anthocyanins, which is how they earn foundational food status. They tend to be particularly high in vitamin C (especially strawberries, supplying 141% of the daily value per cup!), beneficial fiber types, manganese, and in some cases vitamin K, and other vitamins and minerals.

In general, eating two or more servings of berries per week is great for overall health, but again, there's no limit to the benefits of berries! A serving is one cup, measured raw.

Examples of berries include:

- açaí
- blackberry
- blueberry
- cloudberry
- cranberry
- currant
- elderberry
- goji
- gooseberry
- huckleberry
- lingonberry
- loganberry
- mulberry
- muscadine
- Oregon grape
- raspberry
- salmonberry
- strawberry

Pulse Legumes

In epidemiological studies, consumption of legumes is frequently associated with better health and greater longevity. This is attributable to their amazing nutrient-density. Pulse legumes—like lentils, chickpeas, soybeans and black beans—are an extremely concentrated source of beneficial fiber types that are known to increase the growth of probiotic bacteria in our guts, which is how they earn foundational food status. Plus, they're typically great sources of vitamin B1, vitamin B2, vitamin B6, biotin, folate, copper, iron, magnesium, manganese, phosphorous, potassium, selenium and zinc! They contain a good amount of protein and typically are very high in polyphenols.

All in all, even a serving or two per week of pulse legumes—like lentils, chickpeas, soybeans and black beans—is going to deliver health benefit, but the preponderance of scientific evidence supports four servings per week as a great goal for optimal health. Of course, there's no maximum amount of legumes, so you can eat them up to every meal if you like! A serving of whole pulse legumes is half a cup cooked, which is the equivalent of one ounce (or about one fifth of a cup) for raw, dried pulse-legumes (like dried beans or lentils). A serving of tofu, tempeh or natto is a quarter cup.

Examples of pulse legumes include:

- black bean
- black-eyed pea
- chickpea
- common bean
- cranberry bean
- fava bean
- Great Northern bean
- kidney bean
- lentil
- lima bean
- navy bean
- mung bean
- peas (split)
- peanut
- pigeon pea
- pinto bean
- runner bean
- soybean

Nuts and Seeds

Nuts are some of the most nutritious, whole-food healthy fat sources out there! They tend to be our best food sources of vitamin E, plus contain beneficial fiber types, alpha-linolenic acid, and monounsaturated fats, the collection of which grants nuts and seeds foundational food status. They are also usually good sources of copper, magnesium, manganese, vitamin B1, biotin, folate, polyphenols and phytosterols (which lower cholesterol).

It really doesn't take much to see impressive health benefits with nuts and seeds, just three 1-ounce servings per week are associated with huge effects in scientific studies. One ounce (28 grams) of nuts and seeds translates to about a quarter cup if they're whole or chopped, and to two tablespoons for nut and seed butters. Importantly, more is not better with nuts and seeds—studies show that benefits cap out at about an ounce per day.

Examples of nuts and seeds include:

- almonds
- Brazil nut
- cashew
- chia
- coconut
- flax
- hazelnut
- hemp
- macadamia nut
- pecan
- pine nut
- pistachio
- poppy
- pumpkin
- sesame
- sunflower seed
- walnut

Seafood

Seafood is our best source of long-chain omega-3 fatty acids by a mile, solidifying foundational food status, but that's not all! Fish is a great source of vitamins B1, B2, B3, B6, B9, B12 and E, zinc, phosphorus, magnesium, iron, copper, potassium and selenium, with oily cold-water fish also providing substantial amounts of vitamin A and vitamin D. Fish with bones remaining, such as canned salmon and sardines, are the best dietary sources of calcium in the food supply. And marine fish are an excellent dietary source of iodine. And, shellfish are extremely rich sources of vitamin B12, zinc, copper and selenium while also providing impressive amounts of vitamin A, vitamin C, vitamin D, iron, copper, calcium, phosphorus, potassium, magnesium, manganese, iodine and selenium. Shellfish also contain smaller but still notable amounts of vitamins B1, B2, B3, B5, B6, and B9, while also providing dozens of trace minerals. Fish and shellfish are typically, but not always, combined in scientific studies.

Scientific studies make a compelling case for aiming for at least three servings of seafood per week, and up to every meal. A serving of seafood is four ounces (115 grams) raw, or about three ounces cooked, about the same size as your palm.

Examples of seafood include:

- Anchovy
- Bass
- Catfish
- Clam
- Cod
- Crab
- Crawfish
- Hake
- Halibut
- Herring
- Lobster
- Mackerel
- Mahi Mahi
- Mussel
- Octopus
- Oyster
- Prawn
- Salmon
- Sardine
- Scallop
- Shrimp
- Snapper
- Squid
- Tilapia
- Trout
- Tuna

Honorable Mentions

It's worth highlighting a few additional food families with impressive health and nutritional benefits, but which are more nutritionally interchangeable than the Nutrivore foundational foods. You can think of these foods as a bonus if you're looking to up the ante on nutrient density. The honorable mentions of food families are: herbs and spices; olives, avocados and their oils; sea vegetables; fermented foods; tea; broth; and organ meats.

Beyond boosting the flavor of your dish, herbs and spices are concentrated food sources of antioxidant phytonutrients. The health benefits we can glean from herbs and spices are as varied as their distinctive tastes. A good goal is to consume at least one teaspoon of a mix of dried herbs and spices, equivalent to one tablespoon fresh, each day.

Olives, avocados, and their oils are our best foods sources of oleic acid and are also rich in polyphenols and vitamin E. A serving of olive or avocado oil is one tablespoon, and a serving of olives or avocado is ¼ cup, whole or sliced for olives, sliced or mashed for avocado. A good goal is to aim for one or two servings of olives, avocados, or their oils daily.

Sea vegetables deliver unique fiber types, special carotenoids, and 10 times more trace minerals than terrestrial plants. A serving of fresh or rehydrated seaweed is 1 cup (about 15 grams), whereas a serving is 5 grams for dried sea vegetables and 3 grams for sheets (like nori wraps; one of which weighs about 3 grams). A good goal is to aim for at least two servings per week, and up to a serving daily.

Fermented foods, especially raw and unpasteurized, are great sources of probiotics and postbiotics. Some fermented condiments like fish sauce and soy sauce are pasteurized so, while these are great choices, they don't provide all the goodness of other fermented foods. The same is true for vinegar brine-pickled vegetables and eggs, lactofermented meats like salami, and sourdough bread—since heat is involved, you're missing out on live probiotics. There isn't a specific daily recommended intake for probiotics, but every little bit counts! A great goal is to eat some fermented foods every day.

Tea—especially white, green, oolong, black and pu'er teas—are concentrated sources of polyphenols, including catechins. A variety of clinical trials show that drinking two or three cups per day reduces cardiovascular disease risk, reduces risk of some forms of cancer, improves bone mineral density, reduces risk of type 2 diabetes, and reduces risk of depression! Herbal teas vary in their phytonutrient content, and aren't as well studied, but are also good choices. A good goal is to drink two or more 8-ounce cups of tea daily.

Broth or stock—especially when made from the highest collagen tissues like beef marrow bones, chicken feet or fish heads, and long-simmered—is a great source of collagen protein. In addition to improving joint health, collagen improves the appearance of aging skin (including increasing elasticity and moisture, and decreasing fine lines and wrinkles), bone mineral density in menopausal females, and can increase muscle mass and strength in young and old alike. Most studies of collagen consumption show benefits at 10 to 20 grams daily, which is about what you get in once cup of broth.

Organ meat, like liver, kidney and heart, delivers more nutrition per calorie and per serving than just about any other protein foods—mollusks like oysters, mussels and clams are also impressively nutrient dense. Liver and kidney tend to be very high in vitamin A, all of the B vitamins, choline, copper, iron, selenium, zinc and coenzyme Q10. (Coenzyme Q10 is a vitaminlike compound with incredible benefits for human health,

including helping to treat or prevent cardiovascular disease, type 2 diabetes, neurological diseases, gum disease, infertility, migraine, and some cancers.) Even though heart isn't quite as vitamin- and mineral-rich as liver and kidney, it's the single best food source of coenzyme Q10, containing about four times more than liver or kidney. These are exactly the type of impressively nutritious food that earns more room for quality-of-life foods. A serving is 3.5 ounces (100 grams), measured raw, or about 3 ounces cooked, which can be approximated to the size of your palm. A good goal is to eat 3 to 5 servings of organ meat per week, but any amount is a nutritional win.

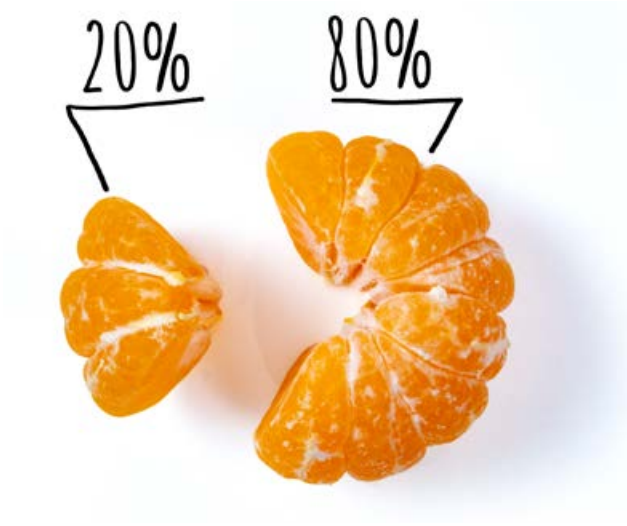
Incorporating any or all of the above foods into your diet is a health boon, by upping your intake of beneficial nutrients.

Essential Nutrivore Eating Patterns

There is a startling lack of data corroborating the claims of most of popular diets; and in fact, studies have failed to demonstrate superiority of any specific diet. Instead, studies substantiate the benefits of eating patterns that: focus on whole and minimally-processed foods, emphasize plant foods, and avoid overeating. These are all eating patterns that are reinforced by the Nutrivore philosophy.

80/20 Whole Foods

The Nutrivore goal of getting all of the nutrients our bodies need from the foods we eat is vastly easier to achieve when we eat a diet comprised of 80% or more whole foods. Whole foods are foods in their natural state or which are minimally processed such that their inherent nutrient content remains intact. Whole foods include fruits, vegetables, whole grains, nuts, seeds, and legumes, as well as unprocessed meats, poultry, and fish. Whole foods are the cornerstone of a healthy eating pattern because they are typically nutrient-dense, providing essential vitamins, minerals, fiber, and antioxidants necessary for optimal health.



Processing is any treatment of a whole food that alters it from its natural state, including removing otherwise edible parts (like removing the bran and germ from brown rice to make white rice), or by adding ingredients (like salt, oil, and sugar). Examples of processed foods include white rice, all-purpose flour, fruits canned in syrup, or sardines canned in oil with added salt. This type of processing can remove some, but not all, of the inherent nutrients. Many processed foods (like canned

vegetables and fish, whole grain breakfast cereal, and cheese) offer valuable nutrition—so within the Nutrivore philosophy, we actually group these foods with whole foods. You might be surprised to read that, but the confusion lies in how often the term processed food is used to describe what's actually an ultra-processed food.

Ultra-processed foods are made mostly or entirely from ingredients extracted from foods through a series of industrial techniques and processes. The more processed or refined a food is, the more nutrients are degraded and ultimately stripped out of it, so one of the things these foods have in common, besides being super convenient and addictively delicious, is they tend to have very little to offer in terms of essential nutrients. Examples of ultra-processed products include soft drinks, energy drinks, salty packaged snacks, candy, packaged bread and cookies, cake and cake mixes, margarine and other spreads, sweetened breakfast cereal, deli meats, American cheese, chicken or fish nuggets, hotdogs, instant soups, and regular pasta noodles.

It's not necessary to eliminate all ultra-processed foods, however. While studies show that, the more ultra-processed foods we eat, the higher our risks of obesity, cancer, type 2 diabetes, cardiovascular disease, depression, and dementia, these risks don't start to increase until at least 20% of our caloric intake is from ultra-processed foods. That means if sticking to a diet in which 80% of the calories come from nutritious whole and processed foods, there's no health harm if the remaining 20% of calories comes from even the most refined, manufactured, additive-laden, ultra-processed options. This means that any food can fit into a healthy diet—it fits within that 20%. It's also pretty easy to meet the Nutrivore goal of getting all of the nutrients our bodies need from the foods we eat within this 80/20 approach and implementing the other essential Nutrivore eating patterns.

High Dietary Diversity

One of the most important features of a health-promoting diet is eating a wide variety of foods, i.e., high dietary diversity. This is because more diverse diets are higher quality and more nutrient-dense. In fact, Dietary Diversity Scores can be used as a proxy for nutrition, with low scores equating to malnourishment and high scores equating to healthy diets. In addition, studies have shown that people who eat 30 or more different plant foods each week have a substantially healthier and more diverse gut microbiome than people who eat 10 or fewer plant foods per week, which is extremely important for supporting our overall health.

In a study that included nearly half a million people living in nine European countries and followed for 22 years, the people in the highest Dietary Species Richness (81 or more different species in the diet over the course of a year) had a 37% reduced risk of all-cause mortality compared to those with the lowest Dietary Species Richness (48 or fewer different species in the diet over the course of a year). The authors calculated that, for every additional 10 species we consume annually, all-cause mortality decreases by 10%! Studies have also shown that high dietary diversity reduces cardiovascular disease and cancer mortality.

While more studies are needed to determine the best target number of different foods per day or per week, the current scientific evidence makes a case for aiming for at least 12 different whole foods per day, and 35 different whole foods over the course of the week.

50% Veggies and Fruit

One of the single most important things we can all do to improve the nutritive value of our diets and lower the risk of health problems is eat plenty of vegetables and fruits, ideally covering half of our plates with them.

A recent review summarized a wealth of scientific studies showing that the more vegetables and fruit we eat, the lower our risk of cancer, cardiovascular disease, type 2 diabetes, obesity, chronic kidney disease, osteoporosis and bone fragility fractures (including hip fracture), cognitive impairment and dementia (including Alzheimer's disease), neurodegenerative diseases, asthma, allergies, chronic obstructive pulmonary disease, age-related macular degeneration, cataracts, glaucoma, depression, ulcerative colitis and Crohn's disease, rheumatoid arthritis, inflammatory polyarthritis, non-alcoholic fatty liver disease, acne, seborrheic dermatitis, and lowers markers of inflammation. There's also emerging evidence for a role for vegetable and fruit intake in lowering markers of inflammation and reducing risk of infection, migraine headaches, colonic diverticulosis, diverticular disease, acute diverticulitis, eczema, and more! In fact, one meta-analysis showed that 2.24 million deaths from cardiovascular disease, 660,000 deaths from cancer, and 7.8 million deaths from all causes could be avoided globally each year if everyone consumed 800 grams of veggies and fruits every day. Wow!

How does this translate to servings of vegetables and fruit? A prudent goal is to consume five or more servings of vegetables per day, along with two or three servings of fruit. Why? Most studies show that this amount and relative ratio provides the majority of the benefits we can glean from high fruit and vegetable intake. A serving is defined as 1 cup chopped for raw vegetables and fruits, and 2 cups for leafy vegetables—this translates to about ½ cup once cooked.

It's additionally beneficial to eat a variety of vegetables and fruit, especially "eating the rainbow." The pigments that give different fruits and vegetables their characteristic colors are phytonutrients; and as we've already seen, each one of these classes of phytonutrients have distinctive benefits, which is why choosing vegetables and fruits of different colors is important for ensuring that we consume a wide variety of these beneficial compounds. One review concluded that 42% of health outcomes were improved by color-associated pigments, and that those health outcomes that were improved by multiple pigments included body weight, lipid profile, inflammation, cardiovascular disease, type 2 diabetes, cancer, and total mortality. In fact, this review shows that color-associated fruit and vegetable variety may confer additional benefits to population health beyond total fruit and vegetable intake. So, aim for dietary representation of each of the five color families for fruits and veggies: red, orange and yellow, green, blue and purple, and white and brown.

It's worth noting that frozen, canned and dried vegetables and fruit are all great options if those are more accessible, affordable, and/or convenient for you.

Balanced Macronutrients

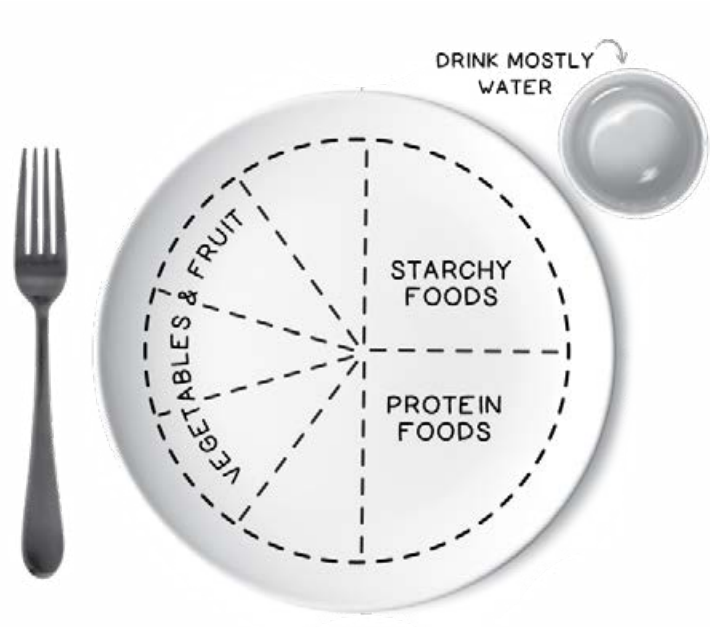
A balanced diet refers to eating a wide range of foods in the right proportions to deliver balanced macronutrients. And balanced macronutrients refers to a diet whose proportion of protein, carbohydrates and fats falls within the Accepted Macronutrient Distribution Ranges, or AMDR. The AMDRs are set by the Food and Nutrition Board of the Institute of Medicine based on evidence from interventional trials with support of epidemiological studies that suggests a role in the prevention or increased risk of chronic diseases, and based on ensuring sufficient intake of essential nutrients (hello, Nutrivore!).

The AMDRs are 10 to 35% calories from protein, 20 to 35% calories from fat, and 45 to 65% calories from carbohydrate (but no more than 25% from sugars). These are the happy medium ranges for protein, fat and carbohydrates that a wealth of scientific studies prove best supports overall health.

Importantly, there's a lot of wiggle room within these AMDR ranges, which means there's a lot of flexibility in adopting a balanced diet. For example, if you eat a 2,000-calorie-per-day diet, your macronutrients would be balanced if you consume anywhere between 50 and 150 grams of protein, 44 to 78 grams of fat, and 190 to 270 grams of carbohydrates with at least 28 grams of fiber.

The Nutrivore Meal Map

Whether cooking at home, or eating out, the easiest way to eat a Nutrivore diet is to follow the Nutrivore Meal Map for most of your meals.



> Mentally, divide your plate into four roughly equal quarters. Each quarter will supply a different collection of vital nutrients, and altogether they will add up to a balanced, nourishing meal.

Fill one quarter of your plate with a starchy food.

One to two servings of a starchy food (defined as one cup raw for starchy vegetables and fruit like plantains, or one ounce raw for pulse legumes and whole grains, all of which translate to about half a cup cooked) at each meal is sufficient to meet carbohydrate needs for most people and contribute substantial dietary fiber to the diet (one serving of sweet potato has 4 grams of fiber and one serving of lentils has 7 grams of fiber).

Fill one quarter of your plate with a protein food.

One to two servings of a protein food (defined as three ounces for cooked meat and seafood; two large eggs; one cup of broth, milk or yogurt; one and a half ounces of cheese; a quarter cup for tofu, and half a cup for cooked pulse legumes like lentils) at each meal is sufficient to meet protein needs for most people, and provided you're consuming a variety of protein foods, ensure adequate intake of all nine essential amino acids. When you select a whole-food plant protein, for example the classic combination of rice and beans (together, a complete protein), merge the quarter of your plate filled with protein foods with the quarter of your plate filled with starchy foods. Processed plant proteins like tofu, tempeh, seitan, plant-based meats and protein powders count only towards the protein quarter and not toward the starch quarter of your plate.

Fill the remaining half of your plate with a variety of vegetables and fruit.

Covering half of your plate with vegetables and fruit (and three quarters of your plate if your starchy food is a root vegetable or winter squash) at each meal is a simple way to easily achieve the goal of five or more servings of vegetables and two servings of fruit daily. Ideally, choose two or more different ones (for example, a quarter of your plate covered in broccoli and a quarter filled with beets) at each meal, hitting all five color families (red, orange and yellow, green, blue and purple, and white and brown) throughout the day, and with as much variety in veggie family over the course of the week as possible.

Cook and dress your food with healthy fats—such as olive oil, avocado oil, soybean oil, canola oil, corn oil or sunflower oil. Alternatively or additionally, incorporate whole food sources of healthy fats into your meal—think fish and shellfish, olives, avocados, nuts and seeds. It's totally fine to use butter or other animal fats (like bacon drippings) for flavor when cooking calls for it, but know that studies do show that swapping out butter and other highly saturated cooking fats for vegetable oils reduces risk of all-cause mortality as well as mortality from specific causes, including cardiovascular disease, diabetes, cancer, respiratory disease, and Alzheimer's disease.

Season as you enjoy with spices and herbs, and know that you're upping the health benefits of your meal when you do! Thanks to their super phytonutrient content, herbs and spices have been shown to have powerful antioxidant activity, exhibit cancer-preventive effects, reduce inflammation, and reduce cardiovascular disease risk.

And finally, drink mostly water.

Choosing mostly water—including flavored or infused waters, sparkling water, club soda, spring or mineral water, and regular ol' tap water—helps to keep us hydrated; but some other beverages are health-promoting when consumed in moderation like tea, coffee, milk, juice and fermented beverages like kombucha, kefir and kvass, and juice.

Using the Nutrivore Meal Map as a visual guide to construct most of your meals will help you eat a balanced, nutrient-dense diet without additional effort. Incorporate a further focus on choosing mostly whole foods, embracing a wide diversity of different foods, and eating the rainbow of fruits and vegetables, and you've got most of your nutritional bases covered!

Nutrivore Meal Map

50%
Vegetables & Fruit

2-5 SERVINGS

E.G., leafy veggies, root veggies, cruciferous veggies, mushrooms, alliums, citrus and berries

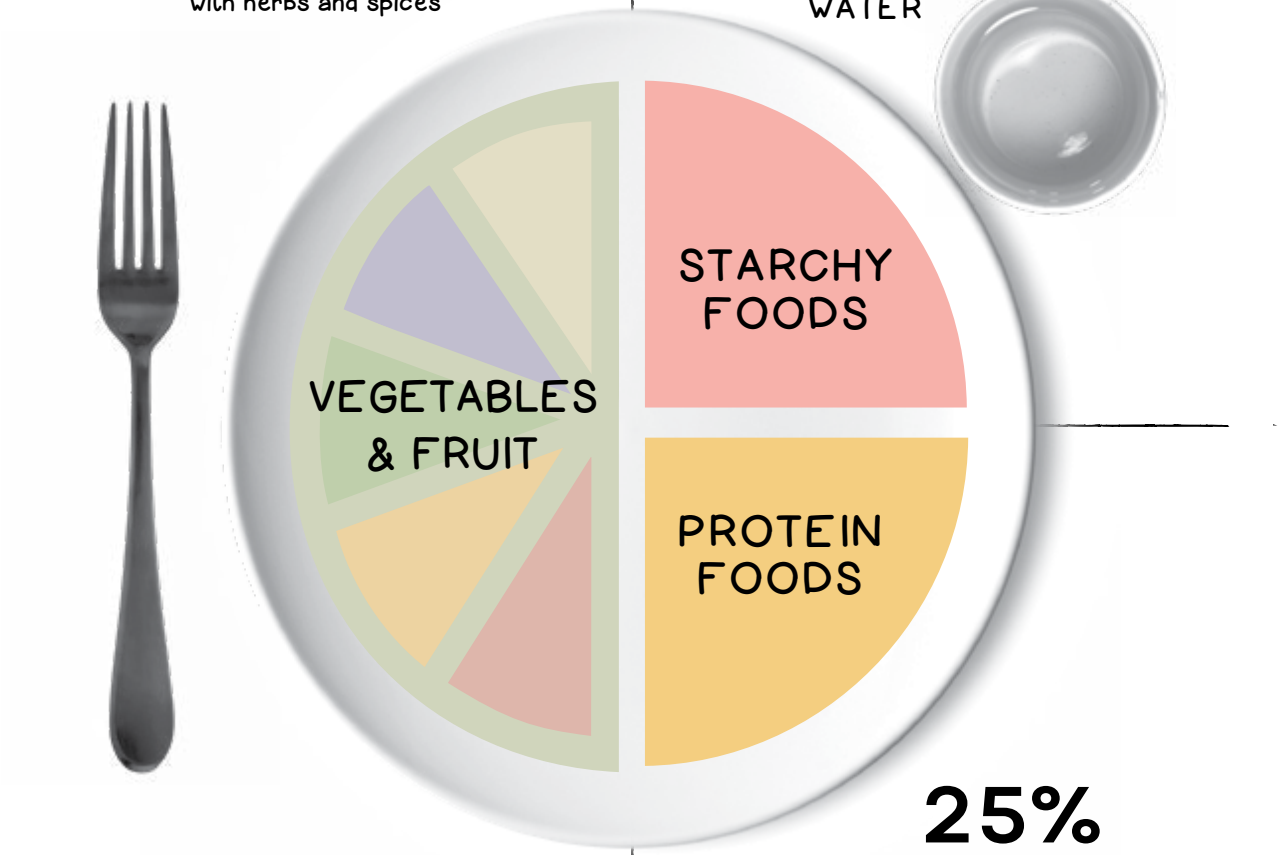
*Season and garnish with herbs and spices

25%
Starchy Foods

1-2 SERVINGS

E.G., pulse legumes, whole grains and starchy vegetables

DRINK MOSTLY WATER



Eat the Rainbow

AIM FOR AT LEAST ONE SERVING OF PLANT FOODS FROM EACH OF THE COLOR FAMILIES DAILY

* Red
* Orange + yellow
* Green
* Blue + purple
* White + brown

CHOOSE HEALTHY FATS

to cook and dress your foods and for meal components

E.G., nuts and seeds, fish, avocados, olives, olive oil, and vegetable oils

25%
Protein Foods

1-2 SERVINGS

E.G., meat, seafood, broth, eggs, dairy and plant proteins

* If choosing whole-food plant proteins like lentils or edamame, merge the starch and protein quarters of your plate.

CHOOSE MOSTLY WHOLE FOODS AND VARY THE FOODS YOU EAT DAY TO DAY

Easy Steps to Nutrivore

Use the tips below as a guide to easily make following a Nutrivore approach a healthy part of your everyday eating.

Eat mostly whole and minimally-processed foods.

- WHOLE FOODS CONTRIBUTE MORE NUTRITION to the diet because their inherent nutrients are intact.
- Whole foods may be completely unprocessed—such as raw carrots, apples, or berries.
- Whole foods can also be minimally-processed or processed foods, which can include removal of edible parts, drying, crushing, cooking without added culinary ingredients, freezing or pasteurization—such as roasted chicken, whole grain breakfast cereal, and cheese.
- It's okay to eat some ultra-processed foods (up to 20% of total calories), but if too many displace more nutrient-dense whole foods, it becomes much, much harder to get enough nutrients.

Cook at home most of the time.

- When you shop for and cook your food yourself, you have complete control over which ingredients are used and the quality of those ingredients.
- COOKING AT HOME SAVES MONEY compared to eating out and is typically more nutritious.
- Most of the time, cooking at home also takes less time than eating out.
- If you don't know how to cook from scratch, find some simple recipes online or in a cookbook to get you started. Experience is the best teacher when it comes to home cooking.
- If most of your meals follow the guidelines below, it's okay to have some meals that don't incorporate nutrient-dense foods and are simply chosen for quality of life.

Cover half your plate with a variety of vegetables and fruit.

- AIM FOR 5 SERVINGS OF VEGETABLES DAILY. A serving of most vegetables is 1 cup raw, or about the size of a fist; a serving of leafy greens is 2 cups raw, or about two fists. Most vegetables shrink to about half that volume when cooked. It's okay to work up to that slowly over time.
    - Aim for 7 or more servings of leafy vegetables per week.
    - Aim for 7 or more servings of cruciferous (the cabbage family) vegetables per week.
    - Aim for 7 or more servings of root vegetables per week (including plantains and winter squash) per week.
    - Aim for 3 or more servings of alliums (the onion family) vegetables per week.
    - Aim for 3 or more servings of mushrooms per week.
- AIM FOR 2 TO 3 SERVINGS OF FRUIT DAILY. It's okay to eat up to twice that amount. A serving is 1 cup raw, or about the size of your fist. Frozen and unsweetened canned options are healthy choices. For dried fruit, ¼ to ½ cup counts as a serving.
    - Aim for 3 or more servings of citrus fruits per week.
    - Aim for 2 or more servings of berries per week
- Raw versus cooked fruits and vegetables are independently beneficial, so it's best to mix it up.

- Round out with other fruit and vegetable families. It's also good to "eat the rainbow", with fruits and veggies of all five color families: red, orange and yellow, green, blue and purple, and white and brown.
- Frozen and canned vegetables are affordable and healthy options.

Cover one quarter of your plate in a starchy food.

- Starchy plant foods include many root vegetables (like sweet potato or potato), starchy fruit (like plantains), winter squash, legumes, and grains.
- AIM FOR 4 OR MORE SERVINGS OF LEGUMES PER WEEK, and up to every meal. A serving of legumes or grains is ½ cup cooked, or about half a fist. Canned and packaged beans are great options.
- Whole grains have more nutrients than refined grains, and are always a better option.
- If you opt for a root vegetable as your starchy food, three quarters of your plate will be fruits and vegetables.

Cover one quarter of your plate in a protein food.

- SEAFOOD AND ORGAN MEAT are the most nutrient-dense protein food options.
- This can include seafood, organ meat, poultry, red meat, broth, eggs, dairy products, and plant proteins. A serving of eggs or meat is 3.5 ounces, or about the size of the palm of your hand or two large eggs. A serving of seafood is 4 ounces, or about the size of the palm of your hand. A serving of cheese is 1.5 ounces. A serving of milk, yogurt or broth is 1 cup.
- When you select a whole-food plant protein, for example the classic combination of rice and beans (together, a complete protein), merge the quarter of your plate filled with protein foods with the quarter of your plate filled with starchy foods. Processed plant proteins like tofu, tempeh, seitan, plant-based meats and protein powders count only towards the protein quarter and not toward the starch quarter of your plate.
- Aim for 3 or more servings of fish and shellfish per week, and up to every meal. A serving is 4 ounces, or about the size of the palm of your hand. Frozen and canned seafood are great options.

Choose healthy fats.

- OPT FOR HEALTHY FATS LIKE OLIVE OIL to cook and dress your foods. Other cooking fats and oils that are linked to health improvements include extra virgin coconut oil, avocado oil, and vegetable oils like non-hydrogenated soybean, canola and corn oil.
- This can include foods like avocados, olives, nuts and seeds.
- AIM FOR 4 TO 7 SERVINGS OF NUT AND SEEDS PER WEEK. A serving is 1 ounce, or about a level cupped palmful.
- You also get healthy fats from fish, shellfish and sea vegetables.
- If most of the fats you eat are healthy fats, it's okay to have some that are chosen for flavor.

Phytonutrient-rich foods promote better health.

- SEASON WITH HERBS AND SPICES LIBERALLY—these are the most concentrated sources of phytonutrients.
- Tea (green, black, white and herbal), coffee and cocoa/cacao (and dark chocolate) are all rich in beneficial phytonutrients.

Eat some fermented foods.

- Fermented foods benefit the gut microbiome and are linked to better health.
- Include foods such as sauerkraut, pickles, kimchi, vinegar, kefir, kombucha, and yogurt.
- AIM TO EAT SOME FERMENTED FOODS DAILY. As little as a teaspoon can be beneficial.

Drink plenty of fluids.

- Aim for 13 cups (101 ounces, or 3 liters) for men and 9 cups (74 ounces, or 2.2 liters) for women of fluid every day.
- The most important thing to drink is water.
- It's better to consume neutral pH to slightly acidic water (like mineral or spring water) and avoid alkaline water.

Choose as much variety as possible.

- Dietary diversity, meaning you eat as many different foods as possible, is independently associated with better health outcomes.
- Aim to eat 35 or more different foods throughout the week. Count any whole or minimally-processed food that you eat cumulatively half a serving of or more throughout the week. It's okay if you work up to this goal slowly over time.
- Different varieties of produce can count towards dietary diversity, such as romaine lettuce and red leaf lettuce.
- It's also beneficial to "eat the rainbow", meaning choosing plant foods from each of the five color families daily: red, orange and yellow, green, blue and purple, and white and brown.

There are a few foods to moderate.

- SALT – keep sodium intake between 3 and 7 grams daily (about 1 to 2.5 teaspoons of salt per day). If you mainly cook at home, you typically don't need to worry about salt intake.
- Alcohol – moderate consumption is no more than four drinks for males and three for females in any given day AND a maximum of 14 drinks for males and 7 drinks for females throughout the week.
- SUGAR – added sugars should ideally be 10% or less of total calories (that's 50 grams of sugar, or about 4 tablespoons, on a 2,000 calorie per day diet). It's okay to have an occasional day when it's higher. Added sugars does not include the sugar content of whole foods like fruit. When considering total dietary sugars, limit to 25% of calories.
- Caffeine – make sure your caffeine intake isn't so high that it disrupts sleep. It can help to only consume caffeinated beverages in the morning.

Healthy lifestyle is also important.

- AIM FOR 8 OR MORE HOURS OF SLEEP every single night on a consistent schedule.
- Aim for at least 150 minutes of moderately-vigorous activity throughout the week. Going on five 30-minute walks per week is a great way to achieve this.
- Include some strength-training exercise in your routine at least twice a week, such as weightlifting, yoga, calisthenics, hill climbing, swimming, heavy gardening, tai chi, cycling, walking up stairs, dance, hiking. Even a 1-minute movement break for squats or push-ups counts!

- Improve your resilience to stress by getting enough sleep, living an active lifestyle, spending some time in nature, fostering healthy relationships, taking social media or technology breaks, and practicing mindful meditation.

Progress > Perfection.

- There's a very small difference in nutrient density between organic versus non-organic produce, grass-fed versus conventional meat, wild-caught versus farmed seafood, etc. Studies also show these are all safe and healthy to consume. So, it's okay to buy the most affordable options.
- It's okay to work up to the serving targets outlined above, and gradually improve the nutritional quality of your diet over time.
- THERE ARE NO "BAD FOODS" ON NUTRIVORE. You don't need to feel guilty about eating a food that isn't particularly nutritious, and instead can celebrate the choices you make that are focused on nutrients.
- Not every food you eat needs to be the pinnacle of nutrient density—your diet can meet your nutritional needs while including some low nutrient-density, quality-of-life foods.
- THERE IS NO ONE PERFECT NUTRIVORE DIET—there is a ton of flexibility of food choice that aligns with Nutrivore principles.
- Nutrivore celebrates every small step you take towards consuming a more nutrient-replete diet.

Nutrivore Score Alphabetical Look-Up

The following are Nutrivore Scores for over 700 foods, ordered alphabetically. Some foods are listed more than once for ease of use. For example, cremini mushrooms are listed both under "Cremini Mushrooms" and "Mushrooms, Cremini"; and, starfruit are listed both under "Starfruit" and "Carambola". The whole edible portion of the raw food is used in the calculation unless otherwise noted.

Food	Nutrivore Score
Abalone	520
Acerola	7877[1]
Acorn squash	297[1]
Adzuki beans	576[1]
Agar	456
Alaskan king crab	1211
Alfalfa Sprouts	902
Allspice, ground	408[1]
Almond butter	213
Almond Flour	216
Almond milk, unsweetened	744
Almond Oil	82
Almonds	234
Almonds, blanched	216
Amaranth	207
Anchovies	805
Anchovies *(canned in oil)*	736
Anise seed	285[1]
Aniseed	285[1]
Antelope	428[2]
Apple juice	69
Apples *(with skin)*	213
Apples, Fuji	131
Apples, Gala	141
Apples, Golden Delicious	141
Apples, Granny Smith	204

Food	Nutrivore Score
Apples, Red Delicious	140
Apricot	260
Apricots, dried	130
Arrowroot	361[1]
Arrowroot flour	14[2]
Artichokes	771
Arugula	2019
Asparagus	1385
Asparagus Lettuce	957[2]
Atlantic salmon, wild	868
Aubergine	563
Avocado Oil	71[1]
Avocados, California	251
Avocados, Florida	291
Baby Bella	2279
Bacon, pork	122
Baking powder, sodium aluminum sulfate	1317
Baking powder, straight phosphate	2815
Baking soda	N/A[4]
Balsamic Vinegar	72[1]
Bamboo shoots	776
Bamboo shoots *(canned)*	420
Banana	185
Barley, pearled	158
Basil	3381
Basil, dried	2035

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Food	Nutrivore Score
Bass, fresh water	555
Bass, striped	786
Bay leaf	572[1]
Beans, Adzuki	576[1]
Beans, Black	446
Beans, Blackeye Peas	286[1]
Beans, broad	442
Beans, butter	340
Beans, Chickpeas	454
Beans, cowpeas	286[1]
Beans, Fava	442
Beans, Garbanzo	454
Beans, Great Northern	414
Beans, green	605
Beans, Green Snap	605
Beans, Kidney	413
Beans, Lima	304
Beans, Lima, Green	340
Beans, Mung	249
Beans, Navy	269
Beans, Pinto	390
Beans, Red Mung	576[1]
Beans, Turtle	446
Beans, White	269
Beaver	196[2]
Beef, arm pot roast	186
Beef, blade roast	187[1]
Beef, brain	738
Beef, broth	336[1]
Beef, chuck eye roast	269
Beef, grass-fed, bottom round steak/roast	337
Beef, grass-fed, ground	208
Beef, grass-fed, ribeye steak/roast	283[1]
Beef, grass-fed, strip loin	371
Beef, grass-fed, top loin steak/roast	261
Beef, ground, 10% fat	244
Beef, ground, 20% fat	165
Beef, ground, 25% fat	142
Beef, ground, 3% fat	360
Beef, ground, 30% fat	125
Beef, ground, 5% fat	316
Beef, ground, 7% fat	284
Beef, heart	862
Beef, heart, New Zealand	974
Beef, kidney	2484
Beef, liver	4021
Beef, pancreas	429[1]
Beef, porterhouse steak	206
Beef, shoulder pot roast/steak	446
Beef, spleen	867[1]
Beef, stock	336[1]
Beef, sweetbreads, pancreas	429[1]
Beef, sweetbreads, thymus	205[1]
Beef, tallow	38
Beef, t-bone steak	280
Beef, tenderloin roast	328
Beef, thymus	205[1]
Beef, tongue	205
Beef, tripe	259
Beef, tri-tip roast	250
Beer	70
Beet greens	3259
Beets	2013
Belgian endive	2390
Bell peppers, green	1094
Bell peppers, red	1358
Bengal Gram	454
Bibb lettuce	1934
Bison, grass-fed, ground	322

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Food	Nutrivore Score
Bison, ground	208
Bison, lean	421
Bison, ribeye, lean	370
Bison, top round, lean	417
Black Beans	446
Black Olives	164
Black Tea	3286
Blackberries	743
Blackeye Peas	286[1]
Blue Cheese	130
Blue crab	1073
Blueberries	396
Bluefin tuna	970
Bog Blueberries	491
Bok Choi	3428
Bok choy	3428
Bone marrow, caribou	56[1]
Boston lettuce	1934
Brain, beef	738
Brain, lamb	767[1]
Brain, pork	469[1]
Brain, veal	682[1]
Brazil nuts	694
Bread, gluten-free, white, made with potato extract, rice starch, and rice flour	42[2]
Bread, gluten-free, white, made with rice flour, corn starch, and/or tapioca	101
Bread, gluten-free, white, made with tapioca starch and brown rice flour	86[2]
Bread, gluten-free, whole grain, made with tapioca starch and brown rice flour	77[2]
Bread, multi-grain	194
Bread, wheat	164[5]
Bread, white	128[5]

[1] Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.
[2] Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.
[3] Nutrivore Score is unreliable as > 50% of data is missing.
[4] Nutrivore Score can't be calculated for non-caloric foods or ingredients.
[5] Nutrivore Score is artificially high due to fortification.

Food	Nutrivore Score
Bread, whole-wheat	215
Brie Cheese	130
Broad Beans	442
Broccoli	2833
Broccoli raab	4155
Broth, beef	336[1]
Broth, chicken	151[1]
Broth, fish	742[1]
Brown mushroom	2279
Brussels sprouts	2817
Buckwheat	303
Buffalo milk	159[1]
Bulgur	140
Bullock's heart	147[2]
Burdock root	182
Butter	57
Butter beans	340
Butter oil	33[1]
Butter, almond	213
Butter, cashew	171[1]
Butter, Cocoa	27
Butter, peanut, chunky	179
Butter, peanut, smooth	172
Butter, sesame seed	289
Butter, sunflower seed	308[1]
Butterhead lettuce	1934
Butternut squash	670
Cabbage, green	2018
Cabbage, kimchi	1097
Cabbage, red	1369
Canada goose, breast, skinless	556
Canola Oil	176
Cantaloupe	457
Cape Gooseberries	134[3]
Capers, canned	5247
Carambola	378

Food	Nutrivore Score
Caraway seed	526
Cardamom	656[2]
Cardoon	1039[2]
Caribou	734[1]
Caribou, bone marrow	56[1]
Carp	480
Carrots	899
Casaba melon	304
Cashew butter	171[1]
Cashews	201
Cassava	224
Cassava Flour	224
Catfish, farmed	305
Catfish, wild	559
Catsup	253
Cauliflower	1585
Caviar, black and red	1582
Celeriac	345[1]
Celery	767
Celery root	345
Celery seed	444
Celtuce	957[2]
Chamomile Tea	988
Chanterelle mushroom	1555
Chard, Rainbow	6573
Chard, swiss	6198
Chayote	871
Cheddar Cheese	126
Cheese, Blue	130
Cheese, Brie	130
Cheese, Cheddar	126
Cheese, Cottage, 2%	201
Cheese, Cream	78
Cheese, Feta	189
Cheese, Gouda	136

Food	Nutrivore Score
Cheese, Mozzarella	145
Cheese, Parmesan, grated	127
Cheese, Parmesan, hard	138
Cheese, Ricotta	141
Cheese, Romano	129
Cheese, Roquefort	146
Cheese, Sharp Cheddar	121
Cheese, Swiss	157
Cherries, sweet	171
Chervil, dried	1038[1]
Chestnuts	389
Chia seeds	450[1]
Chicken eggs	355
Chicken, breast, skinless	309
Chicken, Broth	151[1]
Chicken, dark meat	281
Chicken, drumstick, meat and skin	230
Chicken, drumstick, meat only	297
Chicken, giblets	1191[1]
Chicken, heart	689[1]
Chicken, light meat	296
Chicken, liver	2502
Chicken, meat and skin	205
Chicken, meat only	341
Chicken, stock	151[1]
Chicken, thigh, meat and skin	167
Chicken, thigh, meat only	274
Chicken, wing, meat and skin	174
Chickpeas	454
Chicory Greens	3086
Chicory roots	207[1]
Chicory spear	2390
Chicory, witloof	546[1]
Chinese Broccoli	2365[1]
Chinese Cabbage	3428

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Food	Nutrivore Score
Chinese Date	1239[2]
Chinese Kale	2365[1]
Chinook salmon	775
Chitterlings, pork	96
Chives	3531
Chocolate, 45- 59%	169
Chocolate, 60-69%	192
Chocolate, 70-85%	235
Chocolate, ice cream	93
Chrysanthemum leaves	1093[2]
Chum salmon	646
Cilantro	2609
Cinnamon	1146
Citronella	511[1]
Clams	1046
Clarified butter	33[1]
Clementines	291
Cloudberries	646[1]
Cloves, ground	2209
Cockles	457[3]
Cocoa butter	27
Cocoa, unsweetened	1024
Coconut	179
Coconut butter	162
Coconut cream	165
Coconut milk	171
Coconut milk, canned	184
Coconut Oil	112
Coconut water	271
Coconut, Creamed	162
Cocoyam	178
Cod, Atlantic	431
Cod, Pacific	475
Coffee, brewed	7036
Coffee, brewed, decaf	1826
Coffee, espresso	2304
Coffee, instant	6627
Coffee, instant, chicory	2412[1]
Coffee, instant, decaf	5517
Coho salmon, wild	724
Collards	3323
Coriander leaf, dried	1460[1]
Coriander leaves	2609
Coriander seed	353[2]
Corn oil	103
Corn, sweet, white	191
Corn, sweet, yellow	202
Cos Lettuce	2128
Cottage Cheese, 2%	201
Cowpeas	286[1]
Crab apples	241[2]
Crab, Alaska king	1211
Crab, blue	1073
Crab, dungeness	1077
Crabapples	241[2]
Cranberries	288
Cranberries, dried, sweetened	40
Crayfish, farmed	578
Crayfish, wild	616
Cream Cheese	78
Cremini mushroom	2279
Crimini mushroom	2279
Croaker	476
Crookneck Squash	1177
Cucumber	472
Cumin seed	641
Curly Endive	3086
Currants, black	811
Currants, red and white	393
Curry powder	544
Custard apple	147[2]
Cuttlefish	870[1]
Dandelion greens	2815

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Food	Nutrivore Score
Dates, deglet noor	70
Dates, medjool	81
Deer, ground	437
Deer, meat	683
Dill seed	333[1]
Dill weed	1940
Dill weed, dried	557[2]
Dragon fruit, red	800[1]
Dragon fruit, white	357[1]
Drum, freshwater	494[1]
Duck eggs	396
Duck, meat and skin	201
Dungeness crab	1077
Durian	148[2]
Edamame	362[1]
Edible-podded Peas	669
Eel	385
Egg, white	272
Egg, yolk	342
Eggplant	563
Eggs, chicken	355
Eggs, duck	396
Eggs, goose	398
Eggs, quail	341
Elderberries	546[1]
Elk	718
Emu	733[1]
Endive	2390
Enoki mushroom	4434
Enokitake	4434
Epazote	1270[2]
Fat, goose	43[1]
Fava Beans	442
Feet, pork	112
Fennel	663
Fennel seed	373[2]

Food	Nutrivore Score
Fenugreek seed	264[2]
Feta Cheese	189
Fiddlehead ferns	1721[2]
Figs	158
Figs, dried	141
Filberts	292
Filberts, blanched	323
Fish Sauce	523
Fish, anchovies	805
Fish, anchovies *(canned in oil)*	736
Fish, bass, fresh water	555
Fish, bass, striped	786
Fish, broth	742[1]
Fish, carp	480
Fish, catfish, farmed	305
Fish, catfish, wild	559
Fish, caviar	1582
Fish, cod, Atlantic	431
Fish, cod, Pacific	475
Fish, croaker	476
Fish, drum, freshwater	494[1]
Fish, eel	385
Fish, flatfish	749
Fish, flounder	749
Fish, grouper	400[1]
Fish, haddock	464
Fish, halibut	523
Fish, herring, Atlantic	996
Fish, mackerel, Atlantic	922
Fish, mackerel, king	1242
Fish, mahimahi	416[1]
Fish, milkfish	266[1]
Fish, monkfish	338[1]
Fish, mullett, striped	396
Fish, orange roughy	392
Fish, perch	508
Fish, perch, ocean	464

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Food	Nutrivore Score
Fish, pike, walleye	560
Fish, pollock, Alaskan	528
Fish, pollock, Atlantic	650
Fish, roe	1349
Fish, salmon, chinook	775
Fish, salmon, chum	646
Fish, salmon, pink	625
Fish, salmon, sockeye	750
Fish, salmon, wild Atlantic	868
Fish, salmon, wild Coho	724
Fish, sardines *(canned in oil)*	654
Fish, sea bass	575
Fish, shad	701
Fish, shark	524
Fish, sheepshead	416[1]
Fish, smelt, rainbow	834
Fish, snapper	548
Fish, sole	749
Fish, Stock	732
Fish, sturgeon	528
Fish, swordfish	557
Fish, tilapia	409
Fish, tilefish	553[1]
Fish, trout	710
Fish, trout, rainbow	645
Fish, tuna, bluefin	970
Fish, tuna, skipjack	645
Fish, tuna, yellowfin	642
Fish, whitefish	663
Fish, whiting	455
Flatfish	749
Flaxseed	515
Flaxseed Oil	428
Flounder	749
Flour, arrowroot	14[2]
Flour, cassava	224

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Food	Nutrivore Score
Flour, manioc	224
Flour, wheat, soft-grain	185
Flour, wheat, white, all-purpose	70
Flour, wheat, whole-grain	227
Fuyu, tofu	295
Gai lan	2365[1]
Garbanzo	454
Garden Cress	11265
Garden pepper cress	11265
Garlic	5622
Garlic powder	5529
Ghee	33[1]
Giblets, chicken	1191[1]
Giblets, turkey	1567
Ginger, ground	668
Ginger, root	192
Goat	509[1]
Goat milk *(added vitamin D)*	178[5]
Goji berries, dried	780[3]
Goose eggs	398
Goose, liver	4529[1]
Goose, meat & skin	141
Goose, meat only	311
Gooseberries	459
Gouda Cheese	136
Granadilla	261[1]
Grape juice	110
Grape leaves	1197
Grapefruit juice, pink	293
Grapefruit juice, white	287
Grapefruit, pink and red	361
Grapes, American *(slip skin)*	365
Grapes, European *(red or green)*	271
Grapes, muscadine	644
Grapeseed Oil	82[1]
Graviola	255[1]

Food	Nutrivore Score
Great northern beans	414
Green Beans	605
Green leaf lettuce	2245
Green Olives	160
Green Onions	2097
Green Peas	431
Green snap beans	605
Green Tea	3055
Groundcherries	134[3]
Grouper	400[1]
Guanabana	255[1]
Guavas, common	761
Guavas, strawberry	410
Guinea hen, meat	349[1]
Guinea hen, meat & skin	257[1]
Haddock	464
Halibut	523
Ham, pork	214
Hazelnut Oil	87[1]
Hazelnuts	292
Hazelnuts, blanched	323
Heart, beef	862
Heart, beef, New Zealand	974
Heart, chicken	689[1]
Heart, lamb	916[1]
Heart, pork	977
Hearts of palm	545
Hemp Seeds	415[1]
Herring, Atlantic	996
Honey	20
Honeydew	228
Horned melon	139[2]
Horse	507
Horseradish, prepared	850
Hot Chile Sauce	262[2]

Food	Nutrivore Score
Hubbard squash	358
Huckleberries	317[3]
Hummus	139
Ice cream, chocolate	93
Ice cream, strawberry	99
Ice cream, vanilla	86
Iceberg lettuce	773
Indian Date	77[1]
Indian Fig	881[1]
Inkberry	2330
Intestines, pork	96
Irishmoss	602
Italian brown mushroom	2279
Jackfruit	132[1]
Jam	30
Japanese horseradish	710
Jerusalem-artichokes	195
Jicama	234
Jowl, pork	64[1]
Juice, apple	69
Juice, grape	110
Juice, grapefruit, pink	293
Juice, grapefruit, white	287
Juice, orange	301
Juice, pomegranate	148
Juice, tomato	1568
Jujube	1239[2]
Kaki Fruit	537
Kale	4233
Kefir	296
Kelp	700
Ketchup	253
Kidney Beans	413
Kidney, beef	2484
Kidney, lamb	3481[1]
Kidney, pork	1650
Kimchi *(Cabbage)*	1097

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Food	Nutrivore Score
Kiwano	139[2]
Kiwi, Golden	500
Kiwi, green	453
knob celery	345
Kohlrabi	2497
Komatsuna	5784[1]
Koyadofu, tofu	254[1]
Kumquat	381
Lamb, brain	767[1]
Lamb, ground	186
Lamb, heart	916[1]
Lamb, kidney	3481[1]
Lamb, lean and fat	215
Lamb, leg, lean and fat	191
Lamb, liver	4925[1]
Lamb, pancreas	376[1]
Lamb, shoulder	360
Lamb, spleen	765[1]
Lamb, sweetbreads, pancreas	376[1]
Lamb, tongue	298[1]
Lard	43
Laver	1520
Leeks	1128
Lemon grass	511[1]
Lemon peel	618
Lemons	477
Lentils	489
Lettuce, Bibb	1934
Lettuce, Boston	1934
Lettuce, Butterhead	1934
Lettuce, Cos	2128
Lettuce, Green leaf	2245
Lettuce, Iceberg	773
Lettuce, Red leaf	2684
Lettuce, Romaine	2128
Lichee	319

Food	Nutrivore Score
Lima beans	304
Lima beans, green	340
Limes	344
Linseed	515
Linseed oil	428
Litchi	319
Liver, beef	4021
Liver, chicken	2502
Liver, goose	4529[1]
Liver, lamb	4925[1]
Liver, pork	2483
Lobster, Northern	839
Lobster, spiny	637
Longan	264[2]
Loquat	170[1]
Lotus root	344[1]
Lychee	319
Macadamia nuts	166
Mace, ground	210[1]
Mackerel, Atlantic	922
Mackerel, king	1242
Mahimahi	416[1]
Maitake mushroom	3551
Malay Apple	210[2]
Mamey sapote	488[1]
Mandarin orange	238
Mango	342
Mango, dried, sweetened	247
Manioc	224
Manioc flour	224
Maple Syrup	103
Margarine	78[1]
Marjoram, dried	1278[1]
Marmalade, orange	77
Matai	257
Mayonnaise	90
Melon, cantaloupe	457

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Food	Nutrivore Score
Melon, casaba	304
Melon, horned	139[2]
Melon, watermelon	405
Milk, 1%	251
Milk, 2%	224
Milk, almond, unsweetened	744
Milk, buffalo	159[1]
Milk, coconut	171
Milk, coconut, canned	184
Milk, goat (added vitamin D)	178[5]
Milk, rice, unsweetened	234
Milk, sheep	210[1]
Milk, skim	305
Milk, soy, unsweetened	425[1]
Milk, whole	202
Milkfish	266[1]
Millet	130
Molasses	367
Monkfish	338[1]
Moose	460[2]
Morel mushroom	2271[1]
Mountain Apple	210[2]
Mountain yam, Hawaii	783[1]
Mozzarella Cheese	145
Mulberries	719[1]
Mullet, striped	396
Mung Bean Sprouts	711
Mung beans	249
Mushroom, brown	2279
Mushroom, chanterelle	1555
Mushroom, crimini	2279
Mushroom, enoki	4434
Mushroom, maitake	3551
Mushroom, morel	2271[1]
Mushroom, oyster	2550
Mushroom, portabella	1483

[1] Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.
[2] Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.
[3] Nutrivore Score is unreliable as > 50% of data is missing.
[4] Nutrivore Score can't be calculated for non-caloric foods or ingredients.
[5] Nutrivore Score is artificially high due to fortification.

Food	Nutrivore Score
Mushroom, shiitake	4343
Mushroom, white button	1872
Mussels	1564
Mustard and cress	11265
Mustard greens	5391
Mustard Oil	221[1]
Mustard seed, ground	1904
Mustard spinach	5784[1]
Mustard, yellow	718
Navy beans	269
Nectarines	222
New Zealand spinach	5541[1]
Nigari, tofu, hard	282
Nori	1520
Nutmeg, ground	157
Nuts, Almonds	234
Nuts, Almonds, blanched	216
Nuts, Brazil	694
Nuts, Cashews	201
Nuts, Chestnuts	389
Nuts, Filbert	292
Nuts, Filbert, blanched	323
Nuts, Hazelnuts	292
Nuts, Hazelnuts, blanched	323
Nuts, Macadamia nuts	166
Nuts, peanuts	219
Nuts, peanuts, Spanish	223
Nuts, peanuts, Valencia	217
Nuts, peanuts, Virginia	217
Nuts, Pecans	221
Nuts, Pine nuts	222
Nuts, Pistachios	262
Nuts, Tigernut	192[2]
Nuts, Walnuts	303
Oats	208
Octopus	1618
Oil, Almond	82

Food	Nutrivore Score
Oil, Avocado	71[1]
Oil, Canola	176
Oil, Coconut	112
Oil, Corn	103
Oil, Flaxseed	428
Oil, Grapeseed	82[1]
Oil, Hazelnut	87[1]
Oil, Linseed	428
Oil, Mustard	221[1]
Oil, Olive, Extra-virgin	139
Oil, olive, virgin	106
Oil, Palm	42
Oil, Peanut	90
Oil, Poppyseed	86[1]
Oil, Safflower, high oleic	82
Oil, Safflower, linoleic	88
Oil, Sesame	127
Oil, Soya bean	160
Oil, Soybean	160
Oil, Sunflower, high-oleic	105
Oil, Sunflower, linoleic	104
Oil, Sunflower, mid-oleic	104
Oil, Walnut	126
Okra	859
Olive oil, extra-virgin	139
Olive Oil, Virgin	106
Olives, black	164
Olives, green	160
Onion powder	348
Onions	380
Onions, dehydrated flakes	392
Onions, green	2097
Onions, spring	1932
Onions, Welsh	1704
Oolong Tea	4821
Orange juice	301
Orange peel	353[1]
Orange roughy	392
Oranges	418
Oranges, California, valencias	397
Oranges, Florida	401
Oranges, navels	408
Oregano, dried	1075
Ostrich, ground	348[1]
Ostrich, inside leg	546[1]
Ostrich, outside leg	536[1]
Ostrich, tenderloin	505[1]
Ostrich, top loin	504[1]
Oyster mushroom	2550
Oyster Sauce	162
Oysters, Eastern, wild	3049
Oysters, Pacific	2255
Pak Choi	3428
Pak Choy	3428
Palm Oil	42
Pancreas, beef	429[1]
Pancreas, lamb	376[1]
Pancreas, pork	570[1]
Pancreas, veal	467[1]
Papaya	636
Paprika	847
Parmesan cheese, grated	127
Parmesan cheese, hard	138
Parsley	5491
Parsley, dried	1297
Parsnip	372
Passion-fruit, purple	261[1]
Pea Sprouts	310[1]
Peaches, yellow	295
Peanut butter, chunky	179
Peanut butter, smooth	172
Peanut Oil	90
Peanuts	219

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Food	Nutrivore Score
Peanuts, Spanish	223
Peanuts, Valencia	217
Peanuts, Virginia	217
Pears	145
Pears, Asian	621
Pears, bartlett	132
Pears, bosc	147
Pears, green anjou	125
Pears, red anjou	135
Peas, Edible podded	669
Peas, Green	431
Peas, Split	274
Pecans	221
Pepitas	271
Pepper grass	11265
Pepper, black	635
Pepper, red or cayenne	689
Pepper, white	246[1]
Peppermint	1011[2]
Peppers, hot chili, green	1234
Peppers, hot chili, red	987
Peppers, sweet, green	1094
Peppers, sweet, red	1358
Pepperwort	11265
Perch	508
Perch, Ocean	464
Persimmons, Japanese	537
Persimmons, native	292
Pheasant, breast, skinless	266
Pheasant, leg, skinless	279
Pheasant, meat & skin	246
Pheasant, meat only	318
Pickle relish, hamburger	42[1]
Pickle relish, hot dog	60[1]
Pickle relish, sweet	101
Pickles, dill or kosher dill	593
Pickles, sour	702
Pickles, sweet	107
Pigeon, light meat, skinless	308[1]
Pigeon, meat & skin	180[1]
Pigeon, meat only	368[1]
Pike, walleye	560
Pine nuts	222
Pineapple	358
Pink salmon	625
Pinto Beans	390
Pistachios	262
Pitahaya, red	800[1]
Pitahaya, white	357[1]
Pitaya, red	800[1]
Pitaya, white	357[1]
Plantains, green	173
Plantains, yellow	186
Plum, dried	176
Plums	521
Poha	134[3]
Poke	2330
Pokeberry shoots	2330
Pokeweed	2330
Pollack, Alaskan	528
Pollack, Atlantic	650
Pollock, Alaskan	528
Pollock, Atlantic	650
Pomegranate juice	148
Pomegranates	256
Poor man's pepper	11265
Popcorn, air-popped	118
Popcorn, microwave	95
Popcorn, oil-popped	104
Poppy seed	333
Poppyseed Oil	86[1]
Pork, bacon	122
Pork, brain	469[1]

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Food	Nutrivore Score
Pork, chitterlings	96
Pork, feet	112
Pork, ground	181
Pork, ham	214
Pork, heart	977
Pork, intestine	96
Pork, jowl	64[1]
Pork, kidney	1650
Pork, liver	2483
Pork, loin, lean	315
Pork, loin, lean and fat	222
Pork, pancreas	570[1]
Pork, spleen	591[1]
Pork, sweetbreads, pancreas	570[1]
Pork, tail	91[1]
Pork, tongue	211
Portabella mushroom	1483
Potato	272
Potato chips, plain	105
Potato Crisps, plain	105
Potatoes, red	278
Potatoes, russet	248
Potatoes, white	273
Prairie Turnips	118[2]
Prickly pears	881[1]
Prunes	176
Pumpkin	1036
Pumpkin flowers	1564[1]
Pumpkin leaves	1840
Pumpkin seeds, shelled	271
Quail eggs	341
Quail, breast, skinless	337[1]
Quail, meat & skin	297[1]
Quail, meat only	393[1]
Quince	336[1]
Quinoa	227

[1] Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.
[2] Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.
[3] Nutrivore Score is unreliable as > 50% of data is missing.
[4] Nutrivore Score can't be calculated for non-caloric foods or ingredients.
[5] Nutrivore Score is artificially high due to fortification.

Food	Nutrivore Score
Rabbit	602
Radicchio	2471
Radish sprouts	3429[1]
Radishes	5863
Rainbow trout	645
Raisins, dark, seedless	106
Raisins, golden, seedless	103
Raisins, seeded	114
Rapeseed Oil	176
Rapini	4155
Raspberries	491
Red leaf lettuce	2684
Red Mung Beans	576[1]
Rhubarb	598
Rice milk, unsweetened	234
Rice, brown	154
Rice, white	66
Rice, wild	154
Ricotta Cheese	141
Rocket	2019
Roe	1349
Romaine lettuce	2128
Romano Cheese	129
Roquefort Cheese	146
Rose apple	210[2]
Rose haw	640
Rose hep	640
Rose Hips	640
Rosehip	640
Roselle	191[3]
Rosemary	438[1]
Rosemary, dried	459[1]
Ruffed Grouse, breast, skinless	397[1]
Rutabaga	766
Safflower oil, high oleic	82
Safflower oil, linoleic	88
Saffron	609[1]

Food	Nutrivore Score
Sage, ground	1121
Salmon, Chinook	775
Salmon, Chum	646
Salmon, Pink	625
Salmon, Sockeye	750
Salmon, Wild Atlantic	868
Salmon, Wild Coho	724
Salmonberries	327[2]
Salsify	182
Salt, table	N/A[4]
Sapote	488[1]
Sardines *(canned in oil)*	654
Sauce, fish	523
Sauce, hot chile	262[2]
Sauce, oyster	162
Sauce, soy, made from hydroyzed vegetable protein	259
Sauce, soy, made from soy *(tamari)*	373
Sauce, soy, made from soy and wheat *(shoyu)*	433
Sauerkraut	710
Savory, ground	635[2]
Savoury, ground	635[2]
Scallions	1932
Scallop squash	1394
Scallops	645
Sea bass	575
Sea cucumber, yane	283[3]
Seaweed, Agar	456
Seaweed, Irishmoss	602
Seaweed, Kelp	700
Seaweed, Laver	1520
Seaweed, Nori	1520
Seaweed, Spirulina	1903
Seaweed, Wakame	841

Food	Nutrivore Score
Seed, Chia	450[1]
Seeds, Flax	515
Seeds, Hemp	415[1]
Seeds, Pumpkin	271
Seeds, Sesame	299
Seeds, Sunflower	340
Sesame Oil	127
Sesame Seed Butter	212
Sesame seed butter, paste	289
Sesame seeds	299
Shad	701
Shallots	740
Shark	524
Sharp Cheddar Cheese	121
Sheep milk	210[1]
Sheepshead	416[1]
Shiitake mushroom	4343
Shortening	42
Shoyu	433
Shrimp	535
Skipjack tuna	645
Smelt, rainbow	834
Snail	435
Snapper	548
Sockeye salmon	750
Sole	749
Sour Cream	82
Soursop	255[1]
Soy milk, unsweetened	425[1]
Soy sauce made from hydrolyzed vegetable protein	259
Soy sauce made from soy *(tamari)*	373
Soy sauce made from soy and wheat *(shoyu)*	433
Soya bean	326
Soya bean Oil	160

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Food	Nutrivore Score
Soya beans, green	362[1]
Soya milk, unsweetened	425[1]
Soya sauce made from hydrolyzed vegetable protein	259
Soya sauce made from soy *(tamari)*	373
Soya sauce made from soy and wheat *(shoyu)*	433
Soybean Oil	160
Soybeans	326
Soybeans, green	362[1]
Spaghetti squash	286
Spearmint	914[2]
Spearmint, dried	1336[2]
Spinach	4548
Spirulina	1903
Spleen, beef	867[1]
Spleen, lamb	765[1]
Spleen, pork	591[1]
Spleen, veal	674[1]
Split peas	274
Spring Onion	1932
Sprouts, alfalfa	902
Sprouts, mung bean	711
Sprouts, pea	310[1]
Sprouts, radish	3429[1]
Squab, light meat, skinless	308[1]
Squab, meat & skin	180[1]
Squab, meat only	368[1]
Squash, acorn	297[1]
Squash, butternut	670
Squash, Crookneck	1177
Squash, hubbard	358
Squash, scallop	1394
Squash, spaghetti	286
Squash, Straightneck	1177
Squash, summer	1596
Squash, winter	370
Squash, zucchini	1477
Squid	890
Sriracha	262[2]
Starfruit	378
Stock, beef	336[1]
Stock, chicken	151[1]
Stock, fish	732
Straightneck Squash	1177
Strawberries	762
Sturgeon	528
Sugar apple	204[1]
Sugar, brown	22
Sugar, granulated	1
Sugar, maple	82[1]
Sugar, powdered	1[1]
Sugar, turbinado	14[2]
Summer squash	1596
Sun-dried tomatoes	655
Sunflower oil, high oleic	105
Sunflower Oil, linoleic	104
Sunflower oil, mid-oleic	104
Sunflower seed butter	308[1]
Sunflower seeds	340
Swede	766
Sweet potato	379
Sweet potato leaves	1775
Sweetbreads, beef, pancreas	429[1]
Sweetbreads, beef, thymus	205[1]
Sweetbreads, lamb, pancreas	376[1]
Sweetbreads, pork, pancreas	570[1]
Sweetbreads, veal, pancreas	467[1]
Sweetbreads, veal, thymus	445
Sweetsop	204[1]
Swiss Cheese	157
Swordfish	557
Tahini	212

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Food	Nutrivore Score
Tail, pork	91[1]
Tallow, beef	38
Tamari	373
Tamarind	77[1]
Tangerine	238
Tapioca, pearl	8[1]
Taro	178
Tarragon, dried	642[1]
Tea, black	3286
Tea, camomile	988
Tea, chamomile	988
Tea, green	3055
Tea, Oolong	4821
Tempeh	438[1]
Thyme	942[1]
Thyme, dried	1335
Thymus, beef	205[1]
Thymus, veal	445
Tigernut	192[2]
Tilapia	409
Tilefish	553[1]
Tofu, Fuyu	295
Tofu, hard, nigari	282
Tofu, Koyadofu	254[1]
Tomatillos	621
Tomato juice	1568
Tomato puree	1248
Tomatoes, green	611
Tomatoes, orange	1780
Tomatoes, red	983
Tomatoes, sun-dried	655
Tomatoes, yellow	1738
Tongue, beef	205
Tongue, lamb	298[1]
Tongue, pork	211
Tongue, veal	402

Food	Nutrivore Score
Tripe, beef	259
Trotters	112
Trout	710
Trout, Rainbow	645
Tuna, bluefin	970
Tuna, Skipjack	645
Tuna, Yellowfin	642
Turkey, breast, meat only	317
Turkey, dark meat	418
Turkey, giblets	1567
Turkey, Ground	295
Turkey, light meat	315
Turkey, light meat with skin	228
Turkey, whole, meat & skin	299
Turmeric	637
Turnip	1954
Turnip greens	6370
turnip-rooted celery	345
Turtle Beans	446
Vanilla extract	65[1]
Vanilla, ice cream	86
Veal, brain	682[1]
Veal, ground	230
Veal, leg (top round), lean	354[1]
Veal, leg, top round, cap off, cutlet, boneless	425
Veal, loin, lean & fat	266
Veal, pancreas	467[1]
Veal, rib, lean	316[1]
Veal, shank, lean & fat	385
Veal, shank, separable lean & fat	338[1]
Veal, shoulder, arm, lean & fat	314
Veal, shoulder, blade chop, lean	435
Veal, shoulder, whole, lean	358[1]
Veal, sirloin, lean	365[1]
Veal, spleen	674[1]

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Food	Nutrivore Score
Veal, sweetbreads, pancreas	467[1]
Veal, sweetbreads, thymus	445
Veal, thymus	445
Veal, tongue	402
Vegetable Oyster	182
Vinegar, balsamic	72[1]
Vinegar, cider	131
Vinegar, distilled	33
Wakame	841
Walnut oil	126
Walnuts	303
Wasabi	523
Wasabi, root	710
Water convolvulus	1271[2]
Water spinach	1271[2]
Waterchestnuts	257
Watercress	6929
Watermelon	405
Wax apple	210[2]
Welsh Onions	1704
West Indian Cherries	7877[1]
Wheat flour, soft grain	185
Wheat flour, white, all-purpose	70
Wheat flour, whole-grain	227
Whelk	730
White beans	269
White button mushroom	1872
Whitefish	663
Whiting	455
Wild rice	154
Wine, red	104
Wine, white	42
Winter mushroom	4434
Winter squash	370
Yam	167
Yambean	234
Yeast, baker's, active dry	1202
Yellowfin tuna	642
Yogurt, Greek, whole	178
Yogurt, plain, skim	263
Yogurt, plain, whole	184
Yuca	224
Zucchini	1477

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Nutrivore Score Highest to Lowest

The following are Nutrivore Scores for about 700 foods, arranged from highest to lowest score. Alternative names or spelling of foods are indicated. The whole edible portion of the raw food is used in the calculation unless otherwise noted.

Food	Nutrivore Score
Garden Cress *(AKA Mustard and cress, Garden pepper cress, Pepperwort, Pepper grass, Poor man's pepper)*	11265
Acerola *(AKA West Indian Cherries)*	7877[1]
Coffee, brewed	7036
Watercress	6929
Coffee, instant	6627
Chard, Rainbow	6573
Turnip greens	6370
Chard, swiss	6198
Radishes	5863
Mustard spinach *(AKA Komatsuna)*	5784[1]
Garlic	5622
New Zealand spinach	5541[1]
Garlic powder	5529
Coffee, instant, decaf	5517
Parsley	5491
Mustard greens	5391
Capers, canned	5247
Lamb, liver	4925[1]
Tea, Oolong	4821
Spinach	4548
Goose, liver	4529[1]
Enoki mushroom *(AKA Winter mushroom, Enokitake)*	4434
Shiitake mushroom	4343

Food	Nutrivore Score
Kale	4233
Broccoli raab *(AKA Rapini)*	4155
Beef, liver	4021
Maitake mushroom	3551
Chives	3531
Lamb, kidney	3481[1]
Radish sprouts	3429[1]
Bok choy *(AKA Pak Choy, Chinese Cabbage)*	3428
Basil	3381
Collards	3323
Tea, black	3286
Beet greens	3259
Curly Endive *(AKA Chicory greens)*	3086
Tea, green	3055
Oysters, Eastern, wild	3049
Broccoli	2833
Brussels sprouts	2817
Dandelion greens	2815
Baking powder, straight phosphate	2815
Red leaf lettuce	2684
Cilantro *(AKA Coriander leaves)*	2609
Oyster mushroom	2550
Chicken, liver	2502
Kohlrabi	2497
Beef, kidney	2484
Pork, liver	2483

[1] Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.
[2] Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.
[3] Nutrivore Score is unreliable as > 50% of data is missing.
[4] Nutrivore Score can't be calculated for non-caloric foods or ingredients.
[5] Nutrivore Score is artificially high due to fortification.

Food	Nutrivore Score
Radicchio	2471
Coffee, instant, chicory	2412[1]
Endive *(AKA Belgian endive, Chicory spear)*	2390
Chinese Broccoli *(AKA Chinese Kale, Gai lan)*	2365[1]
Pokeberry shoots *(AKA Poke, Pokeweed, Inkberry)*	2330
Coffee, espresso	2304
Crimini mushroom *(AKA Brown mushroom, Italian brown mushroom, Baby Bella)*	2279
Morel mushroom	2271[1]
Oysters, Pacific	2255
Green leaf lettuce	2245
Cloves, ground	2209
Romaine lettuce *(AKA Cos Lettuce)*	2128
Green Onions	2097
Basil, dried	2035
Arugula *(AKA Rocket)*	2019
Cabbage, green	2018
Beets	2013
Turnip	1954
Dill weed	1940
Butterhead lettuce *(AKA Boston lettuce, Bibb lettuce)*	1934
Scallions *(AKA Spring Onion)*	1932
Mustard seed, ground	1904
Spirulina	1903
White button mushroom	1872
Pumpkin leaves	1840
Coffee, brewed, decaf	1826
Tomatoes, orange	1780
Sweet potato leaves	1775
Tomatoes, yellow	1738
Fiddlehead ferns	1721[2]
Welsh Onions	1704
Pork, kidney	1650

[1] Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.
[2] Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.
[3] Nutrivore Score is unreliable as > 50% of data is missing.
[4] Nutrivore Score can't be calculated for non-caloric foods or ingredients.
[5] Nutrivore Score is artificially high due to fortification.

Food	Nutrivore Score
Octopus	1618
Summer squash	1596
Cauliflower	1585
Caviar, black and red	1582
Tomato juice	1568
Turkey, giblets	1567
Mussels	1564
Pumpkin flowers	1564[1]
Chanterelle mushroom	1555
Laver *(AKA Nori)*	1520
Portabella mushroom	1483
Zucchini	1477
Coriander leaf, dried	1460[1]
Scallop squash	1394
Asparagus	1385
Cabbage, red	1369
Peppers, sweet, red *(AKA Bell peppers, red)*	1358
Roe	1349
Spearmint, dried	1336[2]
Thyme, dried	1335
Baking powder, sodium aluminum sulfate	1317
Parsley, dried	1297
Marjoram, dried	1278[1]
Water convolvulus *(AKA Water spinach)*	1271[2]
Epazote	1270[2]
Tomato puree	1248
Mackerel, king	1242
Jujube *(AKA Chinese Date)*	1239[2]
Peppers, hot chili, green	1234
Alaskan king crab	1211
Yeast, baker's, active dry	1202
Grape leaves	1197
Chicken, giblets	1191[1]
Crookneck & straightneck squash	1177

Food	Nutrivore Score
Cinnamon	1146
Leeks	1128
Sage, ground	1121
Kimchi *(Cabbage)*	1097
Peppers, sweet, green *(AKA Bell peppers, green)*	1094
Chrysanthemum leaves	1093[2]
Dungeness crab	1077
Oregano, dried	1075
Blue crab	1073
Clams	1046
Cardoon	1039[2]
Chervil, dried	1038[1]
Pumpkin	1036
Cocoa, unsweetened	1024
Peppermint	1011[2]
Herring, Atlantic	996
Tea, chamomile	988
Peppers, hot chili, red	987
Tomatoes, red	983
Pork, heart	977
Beef, heart, New Zealand	974
Tuna, bluefin	970
Celtuce *(AKA Asparagus Lettuce)*	957[2]
Thyme	942[1]
Mackerel, Atlantic	922
Lamb, heart	916[1]
Spearmint	914[2]
Alfalfa Sprouts	902
Carrots	899
Squid	890
Prickly pears *(AKA Indian Fig)*	881[1]
Chayote	871
Cuttlefish	870[1]
Salmon, Wild Atlantic	868

Food	Nutrivore Score
Beef, spleen	867[1]
Beef, heart	862
Okra	859
Horseradish, prepared	850
Prickly pears *(AKA Indian Fig)*	848
Paprika	847
Wakame	841
Lobster, Northern	839
Smelt, rainbow	834
Currants, black	811
Anchovies	805
Dragon fruit, red *(AKA Pitaya, red)*	800[1]
Bass, striped	786
Mountain yam, Hawaii	783[1]
Goji berries, dried	780[3]
Bamboo shoots	776
Salmon, Chinook	775
Iceberg lettuce	773
Artichokes	771
Lamb, brain	767[1]
Celery	767
Rutabaga *(AKA Swede)*	766
Lamb, spleen	765[1]
Strawberries	762
Guavas, common	761
Salmon, Sockeye	750
Flatfish *(AKA Flounder, Sole)*	749
Almond milk, unsweetened	744
Blackberries	743
Fish, broth	742[1]
Shallots	740
Beef, brain	738
Anchovies *(canned in oil)*	736
Caribou	734[1]
Emu	733[1]
Fish, Stock	732

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Food	Nutrivore Score
Whelk	730
Salmon, Wild Coho	724
Mulberries	719[1]
Elk	718
Mustard, yellow	718
Mung Bean Sprouts	711
Trout	710
Wasabi, root *(AKA Japanese horseradish)*	710
Sauerkraut	710
Pickles, sour	702
Shad	701
Kelp	700
Brazil nuts	694
Pepper, red or cayenne	689
Chicken, heart	689[1]
Deer, meat	683
Veal, brain	682[1]
Veal, spleen	674[1]
Butternut squash	670
Edible-podded Peas	669
Ginger, ground	668
Fennel	663
Whitefish	663
Cardamom	656[2]
Tomatoes, sun-dried	655
Sardines *(canned in oil)*	654
Pollock, Atlantic	650
Salmon, Chum	646
Cloudberries	646[1]
Tuna, Skipjack	645
Scallops	645
Trout, Rainbow	645
Grapes, muscadine	644
Tarragon, dried	642[1]
Tuna, Yellowfin	642

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Food	Nutrivore Score
Cumin seed	641
Rose Hips *(AKA Rose haw)*	640
Lobster, spiny	637
Turmeric	637
Papaya	636
Savory, ground	635[2]
Pepper, black	635
Salmo, Pink	625
Pears, Asian	621
Tomatillos	621
Lemon peel	618
Crayfish, wild	616
Tomatoes, green	611
Saffron	609[1]
Green Beans *(AKA Green snap beans)*	605
Rabbit	602
Irishmoss	602
Rhubarb	598
Pickles, dill or kosher dill	593
Pork, spleen	591[1]
Crayfish, farmed	578
Adzuki beans (AKA Red Mung Beans)	576[1]
Sea bass	575
Bay leaf	572[1]
Pork, pancreas *(AKA Pork, sweetbreads, pancreas)*	570[1]
Eggplant *(AKA Aubergine)*	563
Pike, walleye	560
Catfish, wild	559
Swordfish	557
Dill weed, dried	557[2]
Canada goose, breast, skinless	556
Bass, fresh water	555
Tilefish	553[1]
Snapper	548
Elderberries	546[1]

Food	Nutrivore Score
Chicory, witloof	546[1]
Ostrich, inside leg	546[1]
Hearts of palm	545
Curry powder	544
Persimmons, Japanese *(AKA Kaki Fruit)*	537
Ostrich, outside leg	536[1]
Shrimp	535
Sturgeon	528
Pollock, Alaskan	528
Caraway seed	526
Shark	524
Halibut	523
Fish Sauce	523
Wasabi	523
Plums	521
Abalone	520
Flaxseed *(AKA Linseed)*	515
Lemon grass *(AKA Citronella)*	511[1]
Goat	509[1]
Perch	508
Horse	507
Ostrich, tenderloin	505[1]
Ostrich, top loin	504[1]
Kiwi, Golden	500
Drum, freshwater	494[1]
Bog Blueberries	491
Raspberries	491
Lentils	489
Mamey sapote *(AKA Sapote)*	488[1]
Carp	480
Lemons	477
Croaker	476
Cod, Pacific	475
Cucumber	472
Pork, brain	469[1]

Food	Nutrivore Score
Veal, pancreas *(AKA Veal, sweetbreads, pancreas)*	467[1]
Perch, Ocean	464
Haddock	464
Moose	460[2]
Gooseberries	459
Rosemary, dried	459[1]
Cockles	457[3]
Cantaloupe	457
Agar	456
Whiting	455
Chickpeas *(AKA Garbanzo, Bengal Gram)*	454
Kiwi, green	453
Chia seeds	450[1]
Beef, shoulder pot roast/steak	446
Black Beans (AKA Turtle Beans)	446
Veal, thymus *(AKA Veal, sweetbreads, thymus)*	445
Celery seed	444
Fava Beans *(AKA Broad Beans)*	442
Rosemary	438[1]
Tempeh	438[1]
Deer, ground	437
Snail	435
Veal, shoulder, blade chop, lean	435
Soy sauce made from soy and wheat (shoyu) (AKA Shoyu)	433
Green Peas	431
Cod, Atlantic	431
Beef, pancreas *(AKA Beef, sweetbreads, pancreas)*	429[1]
Flaxseed Oil *(AKA Linseed oil)*	428
Antelope	428[2]
Soy milk, unsweetened	425[1]
Veal, leg, top round, cap off, cutlet, boneless	425
Bison, lean	421
Bamboo shoots *(canned)*	420

[1] Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.
[2] Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.
[3] Nutrivore Score is unreliable as > 50% of data is missing.
[4] Nutrivore Score can't be calculated for non-caloric foods or ingredients.
[5] Nutrivore Score is artificially high due to fortification.

Food	Nutrivore Score
Oranges	418
Turkey, dark meat	418
Bison, top round, lean	417
Mahimahi	416[1]
Sheepshead	416[1]
Hemp Seeds	415[1]
Great northern beans	414
Kidney Beans	413
Guavas, strawberry	410
Tilapia	409
Oranges, navels	408
Allspice, ground	408[1]
Watermelon	405
Veal, tongue	402
Oranges, Florida	401
Grouper	400[1]
Goose eggs	398
Ruffed Grouse, breast, skinless	397[1]
Oranges, California, valencias	397
Duck eggs	396
Mullet, striped	396
Blueberries	396
Quail, meat only	393[1]
Currants, red and white	393
Onions, dehydrated flakes	392
Orange roughy	392
Pinto Beans	390
Chestnuts	389
Eel	385
Veal, shank, lean & fat	385
Kumquat	381
Onions	380
Sweet potato	379
Starfruit *(AKA Carambola)*	378
Lamb, pancreas *(AKA Lamb, sweetbreads, pancreas)*	376[1]

Food	Nutrivore Score
Soy sauce made from soy *(AKA Tamari)*	373
Fennel seed	373[2]
Parsnip	372
Beef, grass-fed, strip loin	371
Bison, ribeye, lean	370
Winter squash	370
Pigeon, meat only *(AKA Squab, meat only)*	368[1]
Molasses	367
Veal, sirloin, lean	365[1]
Grapes, American *(slip skin)*	365
Soybeans, green *(AKA Edamame)*	362[1]
Grapefruit, pink and red	361
Arrowroot	361[1]
Lamb, shoulder	360
Beef, ground, 3% fat	360
Hubbard squash	358
Veal, shoulder, whole, lean	358[1]
Pineapple	358
Dragon fruit, white *(AKA Pitaya, white)*	357[1]
Chicken eggs	355
Veal, leg (top round), lean	354[1]
Coriander seed	353[2]
Orange peel	353[1]
Guinea hen, meat	349[1]
Ostrich, ground	348[1]
Onion powder	348
Celeriac *(AKA Celery root, turnip-rooted celery, knob celery)*	345
Limes	344
Lotus root	344[1]
Egg, yolk	342
Mango	342
Chicken, meat only	341
Quail eggs	341

[1] Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.
[2] Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.
[3] Nutrivore Score is unreliable as > 50% of data is missing.
[4] Nutrivore Score can't be calculated for non-caloric foods or ingredients.
[5] Nutrivore Score is artificially high due to fortification.

Food	Nutrivore Score
Lima beans, green *(AKA Butter beans)*	340
Sunflower seeds	340
Veal, shank, separable lean & fat	338[1]
Monkfish	338[1]
Beef, grass-fed, bottom round steak/roast	337
Quail, breast, skinless	337[1]
Quince	336[1]
Beef, broth *(AKA Beef, stock)*	336[1]
Poppy seed	333
Dill seed	333[1]
Beef, tenderloin roast	328
Salmonberries	327[2]
Soybeans	326
Hazelnuts, blanched *(AKA Filberts, blanched)*	323
Bison, grass-fed, ground	322
Lychee	319
Pheasant, meat only	318
Huckleberries	317[3]
Turkey, breast, meat only	317
Beef, ground, 5% fat	316
Veal, rib, lean	316[1]
Turkey, light meat	315
Pork, loin, lean	315
Veal, shoulder, arm, lean & fat	314
Goose, meat only	311
Pea Sprouts	310[1]
Chicken, breast, skinless	309
Pigeon, light meat, skinless *(AKA Squab, light meat, skinless)*	308[1]
Sunflower seed butter	308[1]
Catfish, farmed	305
Milk, skim	305
Casaba melon	304

[1] Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.
[2] Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.
[3] Nutrivore Score is unreliable as > 50% of data is missing.
[4] Nutrivore Score can't be calculated for non-caloric foods or ingredients.
[5] Nutrivore Score is artificially high due to fortification.

Food	Nutrivore Score
Lima beans	304
Buckwheat	303
Walnuts	303
Orange juice	301
Sesame seeds	299
Turkey, whole, meat & skin	299
Lamb, tongue	298[1]
Acorn squash	297[1]
Chicken, drumstick, meat only	297
Quail, meat & skin	297[1]
Chicken, light meat	296
Kefir	296
Tofu, Fuyu	295
Turkey, Ground	295
Peaches, yellow	295
Grapefruit juice, pink	293
Persimmons, native	292
Hazelnuts *(AKA Filberts)*	292
Avocados, Florida	291
Clementines	291
Sesame seed butter, paste	289
Cranberries	288
Grapefruit juice, white	287
Spaghetti squash	286
Blackeye Peas *(AKA Cowpeas)*	286[1]
Anise seed *(AKA Aniseed)*	285[1]
Beef, ground, 7% fat	284
Beef, grass-fed, ribeye steak/roast	283[1]
Sea cucumber, yane	283[3]
Tofu, hard, nigari	282
Chicken, dark meat	281
Beef, t-bone steak	280
Pheasant, leg, skinless	279
Potatoes, red	278
Chicken, thigh, meat only	274
Split peas	274

Food	Nutrivore Score
Potatoes, white	273
Potato	272
Egg, white	272
Coconut water	271
Pumpkin seeds, shelled *(AKA Pepitas)*	271
Grapes, European *(red or green)*	271
Navy beans *(AKA White beans)*	269
Beef, chuck eye roast	269
Veal, loin, lean & fat	266
Pheasant, breast, skinless	266
Milkfish	266[1]
Longan	264[2]
Fenugreek seed	264[2]
Yogurt, plain, skim	263
Pistachios	262
Sriracha *(AKA Hot Chile Sauce)*	262[2]
Beef, grass-fed, top loin steak/ roast	261
Passion-fruit, purple *(AKA Granadilla)*	261[1]
Apricot	260
Beef, tripe	259
Soy sauce made from hydrolyzed vegetable protein	259
Guinea hen, meat & skin	257[1]
Waterchestnuts *(AKA Matai)*	257
Pomegranates	256
Soursop *(AKA Guanabana, Graviola)*	255[1]
Tofu, Koyadofu	254[1]
Catsup *(AKA Ketchup)*	253
Avocados, California	251
Milk, 1%	251
Beef, tri-tip roast	250
Mung beans	249

Food	Nutrivore Score
Potatoes, russet	248
Mango, dried, sweetened	247
Pheasant, meat & skin	246
Pepper, white	246[1]
Beef, ground, 10% fat	244
Crabapples	241[2]
Tangerine *(AKA Mandarin orange)*	238
Chocolate, 70-85%	235
Rice milk, unsweetened	234
Jicama *(AKA Yambean)*	234
Almonds	234
Chicken, drumstick, meat and skin	230
Veal, ground	230
Turkey, light meat with skin	228
Honeydew	228
Quinoa	227
Wheat flour, whole-grain	227
Milk, 2%	224
Cassava *(AKA Manioc, Yuca, Cassava Flour, Manioc flour)*	224
Peanuts, Spanish	223
Nectarines	222
Pork, loin, lean and fat	222
Pine nuts	222
Pecans	221
Mustard Oil	221[1]
Peanuts	219
Peanuts, Valencia	217
Peanuts, Virginia	217
Almonds, blanched *(AKA Almond Flour)*	216
Lamb, lean and fat	215
Bread, whole-wheat	215
Almond butter	213
Pork, ham	214

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Food	Nutrivore Score
Almond butter	213
Tahini *(AKA Sesame Seed Butter)*	212
Pork, tongue	211
Rose apple *(AKA Wax apple, Mountain Apple, Malay Apple)*	210[2]
Mace, ground	210[1]
Milk, sheep	210[1]
Beef, grass-fed, ground	208
Oats	208
Bison, ground	208
Amaranth	207
Chicory roots	207[1]
Beef, porterhouse steak	206
Beef, thymus *(AKA Beef, sweetbreads, thymus)*	205[1]
Beef, tongue	205
Chicken, meat and skin	205
Sugar apple *(AKA Sweetsop)*	204[1]
Apples, Granny Smith	204
Corn, sweet, yellow	202
Milk, whole	202
Cottage Cheese, 2%	201
Duck, meat and skin	201
Cashews	201
Beaver	196[2]
Jerusalem-artichokes	195
Bread, multi-grain	194
Tigernut	192[2]
Ginger, root	192
Chocolate, 60-69%	192
Corn, sweet, white	191
Roselle	191[3]
Lamb, leg, lean and fat	191
Feta Cheese	189
Beef, blade roast	187[1]

Food	Nutrivore Score
Plantains, yellow	186
Beef, arm pot roast	186
Lamb, ground	186
Wheat flour, soft grain	185
Banana	185
Coconut milk, canned	184
Yogurt, plain, whole	184
Burdock root	182
Salsify *(AKA Vegetable Oyster)*	182
Pork, ground	181
Pigeon, meat & skin *(AKA Squab, meat & skin)*	180[1]
Coconut	179
Peanut butter, chunky	179
Milk, goat *(added vitamin D)*	178[5]
Yogurt, Greek, whole	178
Taro *(AKA Cocoyam)*	178
Prunes *(AKA Plum, dried)*	176
Canola Oil *(AKA Rapeseed Oil)*	176
Chicken, wing, meat and skin	174
Plantains, green	173
Peanut butter, smooth	172
Coconut milk	171
Cherries, sweet	171
Cashew butter	171[1]
Loquat	170[1]
Chocolate, 45- 59%	169
Yam	167
Chicken, thigh, meat and skin	167
Macadamia nuts	166
Beef, ground, 20% fat	165
Coconut cream	165
Bread, wheat	164[5]
Black Olives	164
Oyster Sauce	162
Coconut, Creamed *(AKA Coconut butter)*	162

[1] Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.
[2] Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.
[3] Nutrivore Score is unreliable as > 50% of data is missing.
[4] Nutrivore Score can't be calculated for non-caloric foods or ingredients.
[5] Nutrivore Score is artificially high due to fortification.

Food	Nutrivore Score
Green Olives	160
Soybean Oil	160
Milk, buffalo	159[1]
Figs	158
Barley, pearled	158
Nutmeg, ground	157
Swiss Cheese	157
Rice, brown	154
Wild rice	154
Chicken, Broth *(AKA Chicken, stock)*	151[1]
Durian	148[2]
Pomegranate juice	148
Pears, bosc	147
Custard apple *(AKA Bullock's heart)*	147[2]
Roquefort Cheese	146
Mozzarella Cheese	145
Pears	145
Beef, ground, 25% fat	142
Ricotta Cheese	141
Apples, Golden Delicious	141
Apples, Gala	141
Figs, dried	141
Goose, meat & skin	141
Apples, Red Delicious	140
Bulgur	140
Olive oil, extra-virgin	139
Horned melon *(AKA Kiwano)*	139[2]
Hummus	139
Parmesan cheese, hard	138
Gouda Cheese	136
Pears, red anjou	135
Groundcherries *(AKA Cape Gooseberries, Poha)*	134[3]
Pears, bartlett	132

Food	Nutrivore Score
Jackfruit	132[1]
Vinegar, cider	131
Apples, Fuji	131
Apricots, dried	130
Brie Cheese	130
Blue Cheese	130
Millet	130
Romano Cheese	129
Bread, white	128[5]
Sesame Oil	127
Parmesan cheese, grated	127
Walnut oil	126
Cheddar Cheese	126
Beef, ground, 30% fat	125
Pears, green anjou	125
Pork, bacon	122
Sharp Cheddar Cheese	121
Prairie Turnips	118[2]
Popcorn, air-popped	118
Raisins, seeded	114
Pork, feet *(AKA Trotters)*	112
Coconut Oil	112
Grape juice	110
Pickles, sweet	107
Olive Oil, Virgin	106
Raisins, dark, seedless	106
Sunflower oil, high oleic	105
Potato chips, plain *(AKA Potato Crisps, plain)*	105
Sunflower Oil, linoleic	104
Sunflower oil, mid-oleic	104
Wine, red	104
Popcorn, oil-popped	104
Corn oil	103
Maple Syrup	103
Raisins, golden, seedless	103

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Food	Nutrivore Score
Bread, gluten-free, white, made with rice flour, corn starch, and/or tapioca	101
Pickle relish, sweet	101
Ice cream, strawberry	99
Pork, chitterlings *(AKA Pork, intestine)*	96
Popcorn, microwave	95
Ice cream, chocolate	93
Pork, tail	91[1]
Peanut Oil	90
Mayonnaise	90
Safflower oil, linoleic	88
Hazelnut Oil	87[1]
Ice cream, vanilla	86
Poppyseed Oil	86[1]
Bread, gluten-free, white, made with tapioca starch and brown rice flour	86[2]
Sour Cream	82
Sugar, maple	82[1]
Safflower oil, high oleic	82
Grapeseed Oil	82[1]
Almond Oil	82
Dates, medjool	81
Cream Cheese	78
Margarine	78[1]
Bread, gluten-free, whole grain, made with tapioca starch and brown rice flour	77[2]
Marmalade, orange	77
Tamarind *(AKA Indian Date)*	77[1]
Vinegar, balsamic	72[1]
Avocado Oil	71[1]
Beer	70
Dates, deglet noor	70
Wheat flour, white, all-purpose	70

Food	Nutrivore Score
Apple juice	69
Rice, white	66
Vanilla extract	65[1]
Pork, jowl	64[1]
Pickle relish, hot dog	60[1]
Butter	57
Caribou, bone marrow	56[1]
Fat, goose	43[1]
Lard	43
Wine, white	42
Pickle relish, hamburger	42[1]
Shortening	42
Bread, gluten-free, white, made with potato extract, rice starch, and rice flour	42[2]
Palm Oil	42
Cranberries, dried, sweetened	40
Tallow, beef	38
Vinegar, distilled	33
Ghee *(AKA Clarified butter, Butter oil)*	33[1]
Jam	30
Cocoa butter	27
Sugar, brown	22
Honey	20
Sugar, turbinado	14[2]
Arrowroot flour	14[2]
Tapioca, pearl	8[1]
Sugar, granulated	1
Sugar, powdered	1[1]
Baking soda	N/A[4]
Salt, table	N/A[4]

[1] *Nutrivore Score May Be Higher Since 10 To 25% Of Data Is Missing.*
[2] *Nutrivore Score Is Likely Higher Since 25 To 50% Of Data Is Missing.*
[3] *Nutrivore Score is unreliable as > 50% of data is missing.*
[4] *Nutrivore Score can't be calculated for non-caloric foods or ingredients.*
[5] *Nutrivore Score is artificially high due to fortification.*

Nutrient Cards

FOR THE

Top 100 Foods

YOU CAN GET AT THE

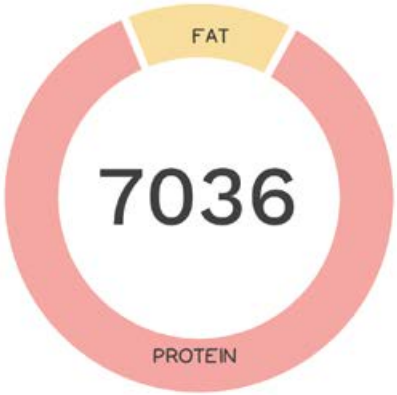
Grocery Store

Coffee, brewed

SUPER

CALORIES: 2

Serving Size:
6 oz (3/4 cup) (178 g)



FIBER	0 g	FAT	0 g
NET CARBS	0 g	PROTEIN	0.2 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Polyphenols	78% DV

Excellent Source

Good Source

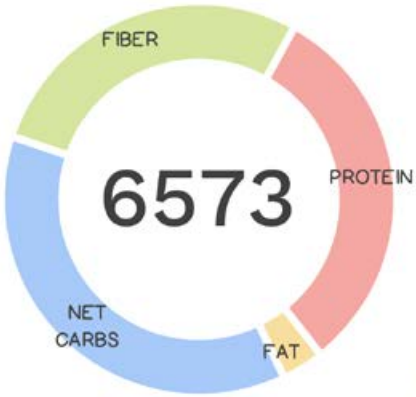
Vitamin B2	10% DV	Vitamin B7	14% DV

Chard, Rainbow

SUPER

CALORIES: 14

Serving Size:
2 cups (72 g)



FIBER	1.2 g	FAT	0.1 g
NET CARBS	1.5 g	PROTEIN	1.3 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Carotenoids	118% DV
Vitamin K	498% DV
Polyphenols	119% DV

Excellent Source

Vitamin C	24% DV	Vitamin A	24% DV

Good Source

Magnesium	14% DV	Betalains	17% DV
Copper	14% DV		
Manganese	11% DV		

Radishes

SUPER

CALORIES: 19

Serving Size:
1 cup (116 g)

FIBER	1.9 g	FAT	0.1 g
NET CARBS	2.1 g	PROTEIN	0.8 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Glucosinolates	976% DV

Excellent Source

Good Source

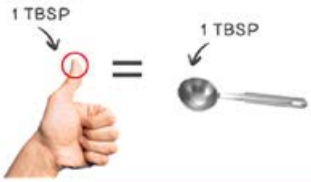
Vitamin C	19% DV	Polyphenols	11% DV
		Vitamin B7	16% DV

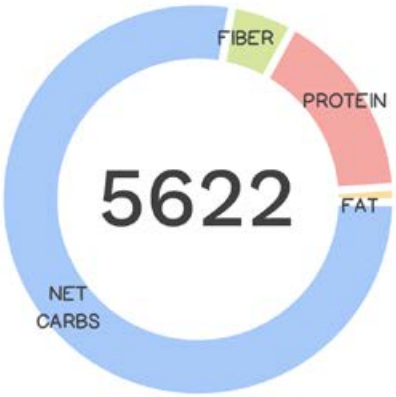
Garlic

SUPER

CALORIES: 13

Serving Size:
1 tablespoon (8.5 g)





FIBER	0.2 g	FAT	0 g
NET CARBS	2.6 g	PROTEIN	0.5 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

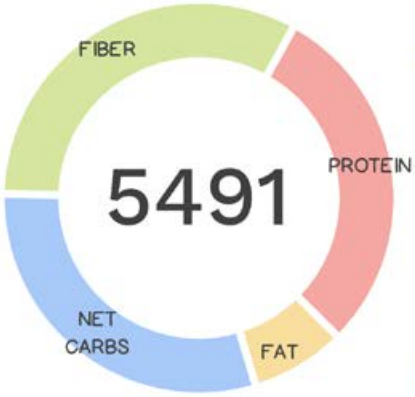
Thiosulfinates	678% DV

Excellent Source

Good Source

Parsley

SUPER



CALORIES: 22

Serving Size:
1/4 cup (60 g)

FIBER	2 g	FAT	0.5 g
NET CARBS	1.8 g	PROTEIN	1.8 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin C	89% DV	Carotenoids	71% DV
		Vitamin K	820% DV

Excellent Source

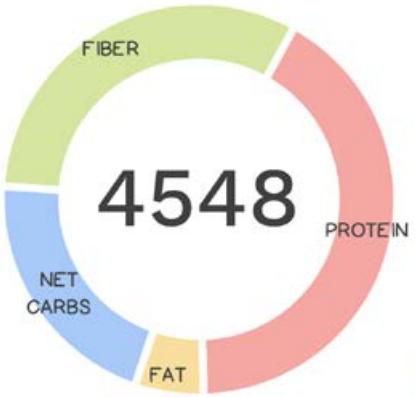
Iron	21% DV	Vitamin A	28% DV
Vitamin B9	23% DV	CoQ10	26% DV

Good Source

Copper	10% DV	Polyphenols	11% DV
		Vitamin B7	12% DV

Spinach

SUPER



CALORIES: 14

Serving Size:
2 cups (60 g)

FIBER	1.3 g	FAT	0.2 g
NET CARBS	0.9 g	PROTEIN	1.7 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

		Carotenoids	119% DV
		Vitamin K	241% DV
		Polyphenols	52% DV

Excellent Source

Manganese	23% DV	Vitamin A	31% DV
Vitamin B9	29% DV		

Good Source

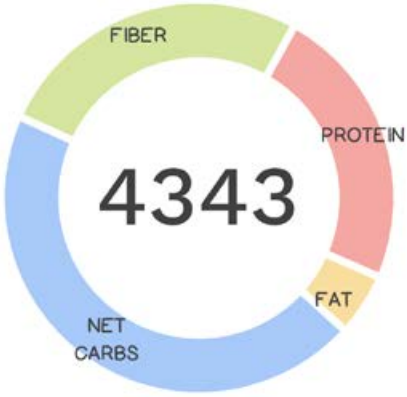
Magnesium	11% DV	CoQ10	10% DV
Vitamin C	19% DV		

Shiitake mushroom

SUPER

CALORIES: 29

Serving Size:
1 cup sliced (86 g)



FIBER	2.2 g	FAT	0.4 g
NET CARBS	3.7 g	PROTEIN	1.9 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Ergothioneine	1086% DV

Excellent Source

Vitamin B3	21% DV
Vitamin B5	26% DV

Good Source

Copper	14% DV	Vitamin B7	19% DV
Vitamin B2	14% DV		
Vitamin B6	15% DV		

Kale

SUPER

CALORIES: 18

Serving Size:
2 cups (50 g)

FIBER	2.1 g	FAT	0.7 g
NET CARBS	0.2 g	PROTEIN	1.5 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin C	54% DV	Carotenoids	51% DV
		Vitamin K	162% DV
		Vitamin B7	60% DV
		Glucosinolates	264% DV

Excellent Source

Manganese	20% DV	Polyphenols	22% DV

Good Source

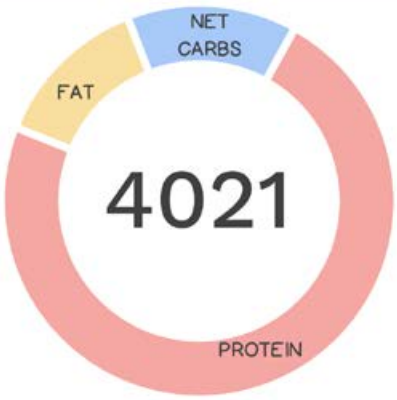
Calcium	10% DV	Vitamin A	13% DV
Vitamin B2	13% DV	ALA	12% DV

Beef, liver

SUPER

CALORIES: 135

Serving Size:
3.5 ounces (100 g)



FIBER	0 g	FAT	3.6 g
NET CARBS	3.9 g	PROTEIN	20.4 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Copper	1084% DV	Vitamin A	552% DV
Selenium	72% DV	Vitamin B7	333% DV
Vitamin B2	212% DV	CoQ10	84% DV
Vitamin B3	82% DV		
Vitamin B5	143% DV		
Vitamin B6	64% DV		
Vitamin B9	73% DV		
Choline	61% DV		
Vitamin B12	2471% DV		

Excellent Source

Protein	41% DV
Iron	27% DV
Phosphorus	31% DV
Zinc	36% DV

Good Source

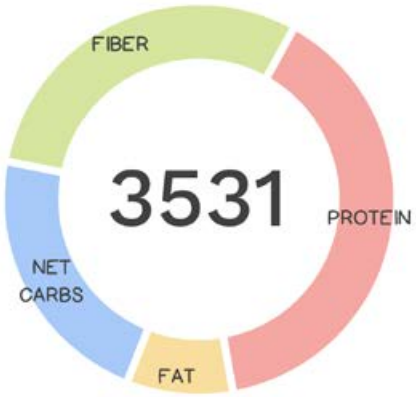
Manganese	13% DV	Taurine	11% DV
Vitamin B1	16% DV		

Chives

SUPER

CALORIES: 4

Serving Size:
1/4 cup chopped (12 g)



FIBER	0.3 g	FAT	0.1 g
NET CARBS	0.2 g	PROTEIN	0.4 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Thiosulfinates	70% DV

Excellent Source

Vitamin K	21% DV

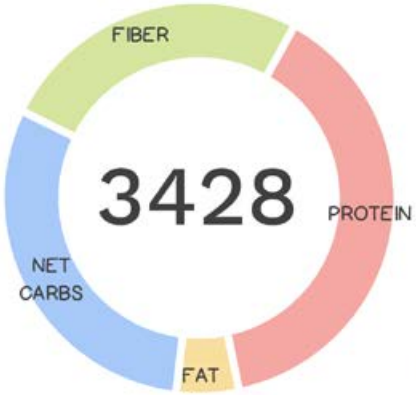
Good Source

Bok choy

SUPER

CALORIES: 9

Serving Size:
1 cup, shredded (70 g)



FIBER	0.7 g	FAT	0.1 g
NET CARBS	0.8 g	PROTEIN	1.1 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Glucosinolates	118% DV

Excellent Source

Vitamin C	35% DV	Carotenoids	21% DV
		Vitamin K	27% DV
		Polyphenols	23% DV

Good Source

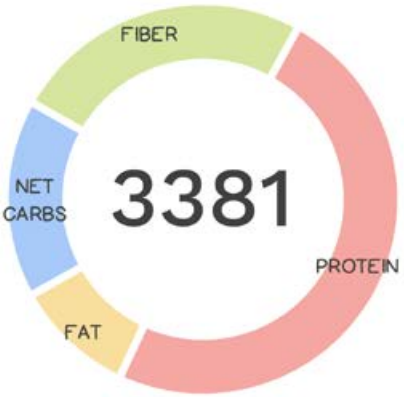
Vitamin B9	12% DV	Vitamin A	17% DV

Basil

SUPER

CALORIES: 1

Serving Size:
1/4 cup (6 g)



FIBER	0.1 g	FAT	0 g
NET CARBS	0.1 g	PROTEIN	0.2 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Excellent Source

Vitamin K	21% DV

Good Source

Collards

SUPER

CALORIES: 23

Serving Size:
2 cups, chopped (72 g)

FIBER	2.9 g	FAT	0.4 g
NET CARBS	1 g	PROTEIN	2.2 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Carotenoids	59% DV
Vitamin K	262% DV
Glucosinolates	241% DV

Excellent Source

Manganese	21% DV	Vitamin A	20% DV
Vitamin C	28% DV	Polyphenols	22% DV
Vitamin B9	23% DV		

Good Source

Fiber	10% DV	Vitamin E	11% DV
Calcium	13% DV		

Tea, black

SUPER

CALORIES: 2

Serving Size:
1 cup (237 g)

FIBER	0 g	FAT	0 g
NET CARBS	0.7 g	PROTEIN	0 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

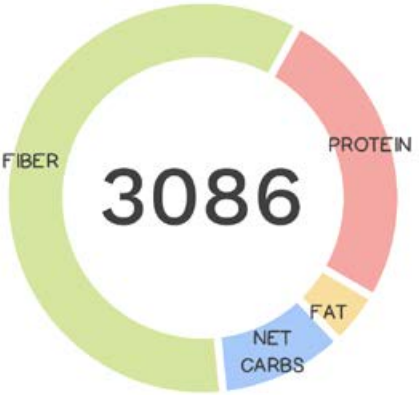
Excellent Source

Manganese	23% DV	Polyphenols	40% DV

Good Source

Curly Endive

SUPER



CALORIES: 13

FIBER	2.3 g	FAT	0.2 g
NET CARBS	0.4 g	PROTEIN	1 g

Serving Size:
2 cups, chopped (58 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Carotenoids	88% DV
Vitamin K	144% DV

Excellent Source

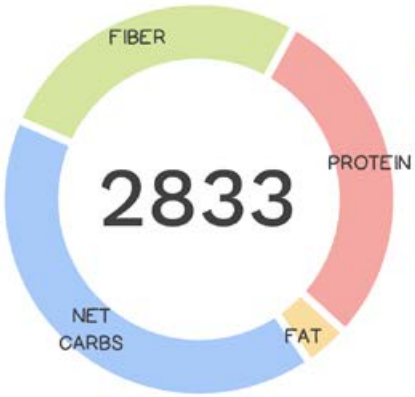
Polyphenols	21% DV

Good Source

Copper	19% DV	Vitamin A	18% DV
Manganese	11% DV		
Vitamin C	15% DV		
Vitamin B5	13% DV		
Vitamin B9	16% DV		

Broccoli

SUPER



CALORIES: 31

FIBER	2.4 g	FAT	0.3 g
NET CARBS	3.7 g	PROTEIN	2.6 g

Serving Size:
1 cup (91 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin C	90% DV	Vitamin K	77% DV
		Glucosinolates	497% DV

Excellent Source

Polyphenols	38% DV
Vitamin B7	28% DV

Good Source

Vitamin B5	10% DV	Carotenoids	18% DV
Vitamin B9	14% DV	CoQ10	13% DV

Brussels sprouts

SUPER

CALORIES: 38

Serving Size:
1 cup (88 g)

FIBER	3.3 g	FAT	0.3 g
NET CARBS	4.5 g	PROTEIN	3 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin C	83% DV	Vitamin K	130% DV
		Glucosinolates	653% DV

Excellent Source

Carotenoids	20% DV
Polyphenols	39% DV

Good Source

Fiber	12% DV
Manganese	13% DV
Vitamin B1	10% DV
Vitamin B6	11% DV
Vitamin B9	13% DV

Red leaf lettuce

SUPER

CALORIES: 7

Serving Size:
2 cups, shredded (56 g)

FIBER	0.5 g	FAT	0.1 g
NET CARBS	0.8 g	PROTEIN	0.7 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin K	65% DV

Excellent Source

Vitamin A	23% DV
Carotenoids	39% DV

Good Source

Vitamin B7	11% DV

Cilantro

SUPER

CALORIES: 2

Serving Size:

1/4 cup, chopped (8 g)

FIBER	0.2 g	FAT	0.04 g
NET CARBS	0.1 g	PROTEIN	0.2 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Excellent Source

Vitamin K	21% DV

Good Source

Oyster mushroom

SUPER

CALORIES: 28

Serving Size:

1 cup sliced (86 g)

FIBER	2 g	FAT	0.4 g
NET CARBS	3.3 g	PROTEIN	2.8 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Ergothioneine	500% DV

Excellent Source

Copper	23% DV	Vitamin B7	34% DV
Vitamin B2	23% DV		
Vitamin B3	27% DV		
Vitamin B5	22% DV		

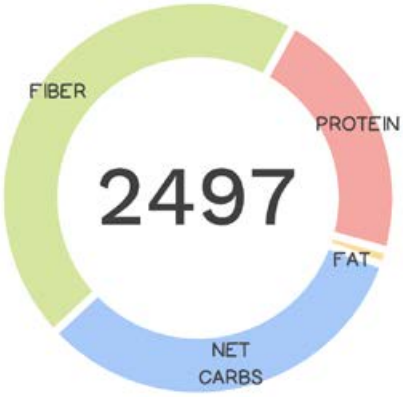
Good Source

Kohlrabi

SUPER

CALORIES: 36

Serving Size:
1 cup (135 g)



FIBER	4.9 g	FAT	0.1 g
NET CARBS	3.5 g	PROTEIN	2.3 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin C	93% DV	Glucosinolates	666% DV

Excellent Source

Polyphenols	28% DV

Good Source

Fiber	17% DV
Potassium	10% DV
Copper	19% DV
Vitamin B6	12% DV

Beef, kidney

SUPER

CALORIES: 99

Serving Size:
3.5 ounces (100 g)

FIBER	0 g	FAT	3.1 g
NET CARBS	0.3 g	PROTEIN	17.4 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Selenium	256% DV	Vitamin B7	299% DV
Vitamin B2	218% DV	CoQ10	84% DV
Vitamin B3	50% DV		
Vitamin B5	79% DV		
Vitamin B12	1146% DV		

Excellent Source

Protein	35% DV	Vitamin A	47% DV
Iron	26% DV		
Phosphorus	21% DV		
Copper	47% DV		
Vitamin B1	30% DV		
Vitamin B6	39% DV		
Vitamin B9	25% DV		

Good Source

Zinc	17% DV	Taurine	11% DV
Vitamin C	10% DV		

Radicchio

SUPER

CALORIES: 18

FIBER	0.7 g	FAT	0.2 g
NET CARBS	2.9 g	PROTEIN	1.1 g

Serving Size:
2 cups, shredded (80 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Carotenoids	79% DV
Vitamin K	170% DV
Polyphenols	101% DV

Excellent Source

Copper	30% DV

Good Source

Vitamin B9	12% DV	Vitamin E	12% DV

Endive

SUPER

CALORIES: 17

FIBER	3.1 g	FAT	0.2 g
NET CARBS	0.3 g	PROTEIN	1.3 g

Serving Size:
2 cups (100 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin K	193% DV

Excellent Source

Vitamin B9	36% DV

Good Source

Fiber	11% DV	Vitamin A	12% DV
Copper	11% DV	Carotenoids	14% DV
Manganese	18% DV	Polyphenols	14% DV
Vitamin B5	18% DV	Vitamin B7	16% DV

Chinese Broccoli

SUPER

CALORIES: 24

Serving Size:
1 cup (91 g)

FIBER	2.4 g	FAT	0.7 g
NET CARBS	1.9 g	PROTEIN	1.1 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin C	158% DV	Carotenoids	99% DV
		Vitamin K	68% DV
		Glucosinolates	91% DV

Excellent Source

Vitamin B9	24% DV

Good Source

Vitamin B2	11% DV	ALA	15% DV
		Polyphenols	18% DV

Crimini mushroom

SUPER

CALORIES: 19

Serving Size:
1 cup whole (87 g)

FIBER	0.5 g	FAT	0.1 g
NET CARBS	3.2 g	PROTEIN	2.2 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Ergothioneine	143% DV

Excellent Source

Copper	48% DV	Vitamin B7	46% DV
Selenium	41% DV		
Vitamin B2	33% DV		
Vitamin B3	21% DV		
Vitamin B5	26% DV		

Good Source

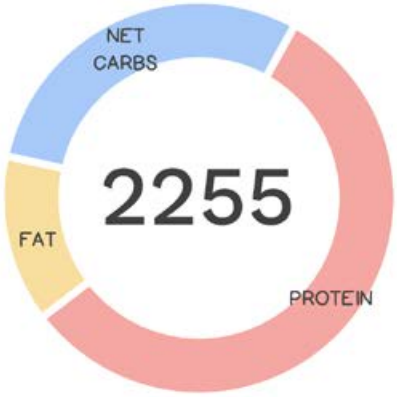
Polyphenols	10% DV

Oysters, Pacific

SUPER

CALORIES: 93

Serving Size:
4 ounces (115 g)



FIBER	0 g	FAT	2.6 g
NET CARBS	5.7 g	PROTEIN	10.9 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Zinc	174% DV	EPA + DHA	316% DV
Copper	201% DV	Vitamin B7	157% DV
Selenium	161% DV	Taurine	114% DV
Vitamin B12	767% DV		

Excellent Source

Protein	22% DV
Iron	33% DV
Manganese	32% DV
Iodine	48% DV
Vitamin B2	21% DV

Good Source

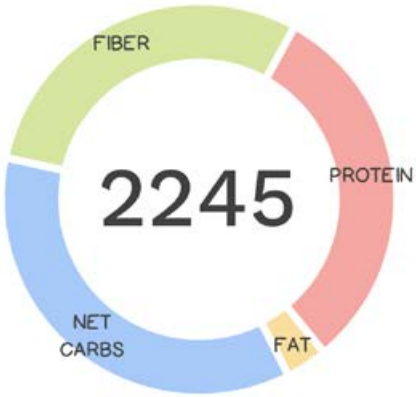
Phosphorus	15% DV	Vitamin A	10% DV
Vitamin C	10% DV		
Vitamin B3	14% DV		
Vitamin B5	12% DV		

Green leaf lettuce

SUPER

CALORIES: 11

Serving Size:
2 cups (72 g)



FIBER	0.9 g	FAT	0.1 g
NET CARBS	1.1 g	PROTEIN	1 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin K	76% DV

Excellent Source

Vitamin A	30% DV
Carotenoids	49% DV

Good Source

Polyphenols	12% DV

Romaine lettuce

SUPER

CALORIES: 16

FIBER	2 g	FAT	0.3 g
NET CARBS	1.1 g	PROTEIN	1.2 g

Serving Size:
2 cups or 4 large leaves (94 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Carotenoids	79% DV
Vitamin K	80% DV

Excellent Source

Vitamin B9	32% DV	Vitamin A	46% DV

Good Source

Polyphenols	15% DV

Green Onions

SUPER

CALORIES: 5

FIBER	0.3 g	FAT	0.1 g
NET CARBS	0.7 g	PROTEIN	0.2 g

Serving Size:
1/4 cup (17.75 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Excellent Source

Vitamin K	23% DV
Thiosulfinates	48% DV

Good Source

Arugula

SUPER

CALORIES: 10

Serving Size:
2 cups (40 g)

FIBER	0.6 g	FAT	0.3 g
NET CARBS	0.8 g	PROTEIN	1 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Glucosinolates	65% DV

Excellent Source

Carotenoids	22% DV
Vitamin K	36% DV

Good Source

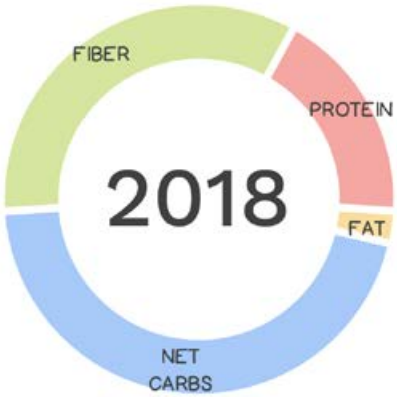
Vitamin B9	10% DV

Cabbage, green

SUPER

CALORIES: 21

Serving Size:
1 cup, chopped (89 g)



FIBER	2 g	FAT	0.2 g
NET CARBS	2.7 g	PROTEIN	1.1 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin C	50% DV	Vitamin K	56% DV
		Glucosinolates	220% DV

Excellent Source

Polyphenols	25% DV

Good Source

Vitamin B9	13% DV

Beets

SUPER

CALORIES: 58

Serving Size:
1 cup (136 g)

FIBER	3.8 g	FAT	0.2 g
NET CARBS	9.2 g	PROTEIN	2.2 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Betalains	983% DV

Excellent Source

Vitamin B9	37% DV	Polyphenols	41% DV

Good Source

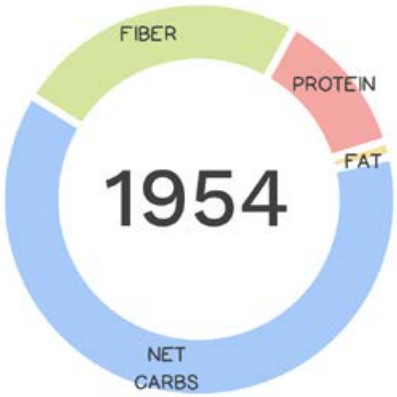
Fiber	14% DV
Copper	11% DV
Manganese	19% DV

Turnip

SUPER

CALORIES: 36

Serving Size:
1 cup cubes (130 g)



FIBER	2.3 g	FAT	0.1 g
NET CARBS	6 g	PROTEIN	1.2 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Glucosinolates	574% DV

Excellent Source

Vitamin C	30% DV

Good Source

Copper	12% DV	Polyphenols	15% DV

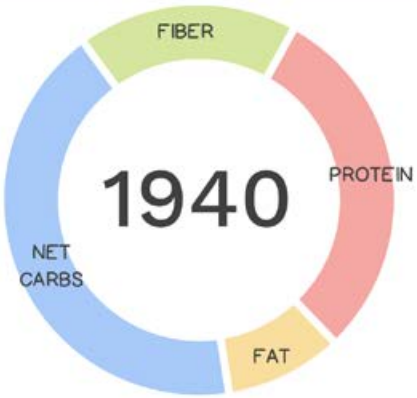
Dill weed

SUPER

CALORIES: 3

Serving Size:

1/4 cup (8 g)



FIBER	0.2 g	FAT	0.1 g
NET CARBS	0.4 g	PROTEIN	0.3 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Excellent Source

Good Source

Carotenoids	10% DV
Vitamin K	19% DV

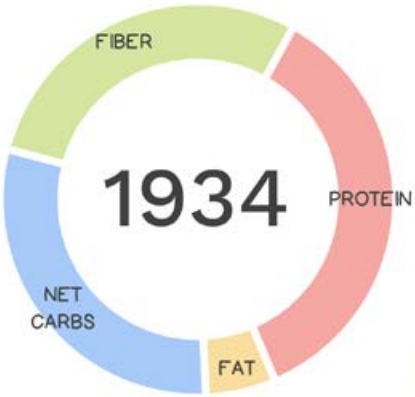
Butterhead lettuce

SUPER

CALORIES: 14

Serving Size:

2 cups (110 g)



FIBER	1.2 g	FAT	0.2 g
NET CARBS	1.2 g	PROTEIN	1.5 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin K	94% DV

Excellent Source

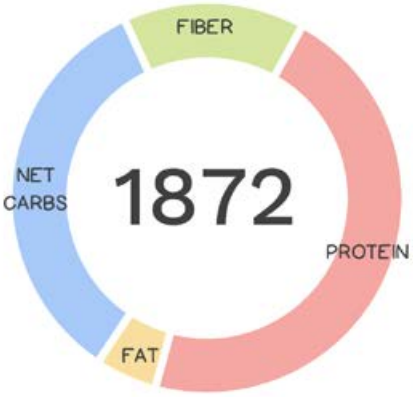
Vitamin B9	20% DV	Vitamin A	20% DV
		Carotenoids	39% DV

Good Source

Polyphenols	18% DV

White button mushroom

SUPER



CALORIES: 21

Serving Size:
1 cup whole (96 g)

FIBER	1 g	FAT	0.3 g
NET CARBS	2.2 g	PROTEIN	3 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin B7	51% DV
Ergothioneine	145% DV

Excellent Source

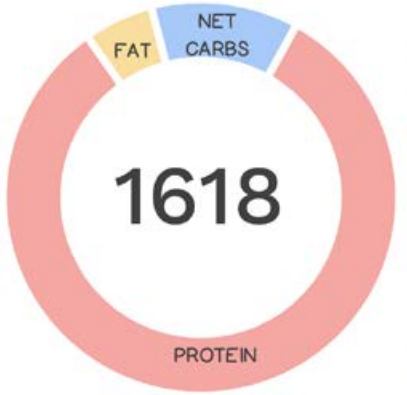
Copper	34% DV
Vitamin B2	30% DV
Vitamin B3	22% DV
Vitamin B5	29% DV

Good Source

Selenium	16% DV

Octopus

SUPER



CALORIES: 94

Serving Size:
4 ounces (115 g)

FIBER	0 g	FAT	1.2 g
NET CARBS	2.5 g	PROTEIN	17.1 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Copper	56% DV	EPA + DHA	72% DV
Selenium	94% DV	Taurine	112% DV
Vitamin B12	958% DV		

Excellent Source

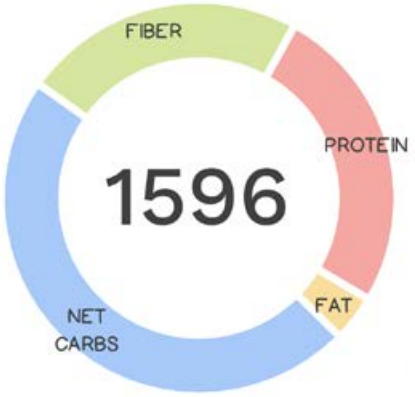
Protein	34% DV
Iron	34% DV
Vitamin B6	24% DV

Good Source

Phosphorus	17% DV	Vitamin B7	11% DV
Zinc	18% DV		
Iodine	15% DV		
Vitamin B3	15% DV		
Vitamin B5	12% DV		
Choline	14% DV		

Summer squash

SUPER



CALORIES: 18

FIBER	1.2 g	FAT	0.2 g
NET CARBS	2.5 g	PROTEIN	1.4 g

Serving Size:
1 cup sliced, about 1 small (113

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Polyphenols	122% DV

Excellent Source

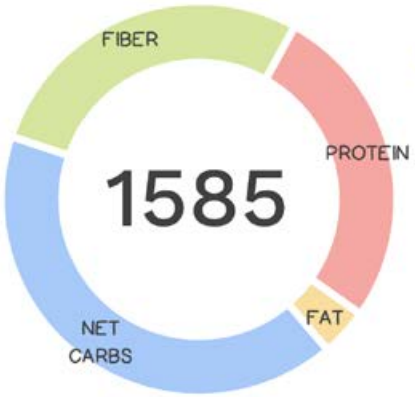
Vitamin C	21% DV	Carotenoids	28% DV

Good Source

Vitamin B2	12% DV	Vitamin B7	10% DV
Vitamin B6	14% DV		

Cauliflower

SUPER



CALORIES: 27

FIBER	2.1 g	FAT	0.3 g
NET CARBS	3.2 g	PROTEIN	2.1 g

Serving Size:
1 cup, chopped (107 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin C	57% DV	Vitamin B7	61% DV
		Glucosinolates	140% DV

Excellent Source

Polyphenols	37% DV

Good Source

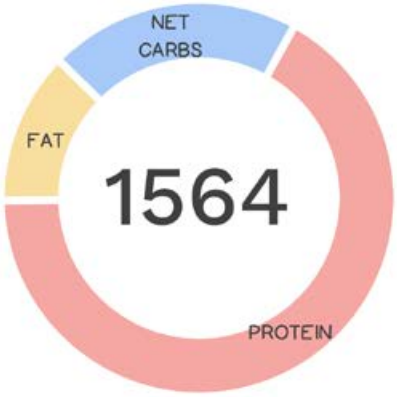
Vitamin B5	14% DV	Vitamin K	14% DV
Vitamin B6	12% DV	CoQ10	12% DV
Vitamin B9	15% DV		

Mussels

SUPER

CALORIES: 99

Serving Size:
4 ounces (115 g)



FIBER	0 g	FAT	2.6 g
NET CARBS	4.2 g	PROTEIN	13.7 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Manganese	170% DV	EPA + DHA	203% DV
Selenium	94% DV	Vitamin B7	87% DV
Iodine	80% DV	Taurine	188% DV
Vitamin B12	575% DV		

Excellent Source

Protein	27% DV
Iron	25% DV

Good Source

Phosphorus	18% DV	CoQ10	18% DV
Zinc	17% DV		
Copper	12% DV		
Vitamin C	10% DV		
Vitamin B1	15% DV		
Vitamin B2	19% DV		
Vitamin B3	12% DV		
Vitamin B5	12% DV		
Vitamin B9	12% DV		
Choline	14% DV		

Laver

SUPER

CALORIES: 14

Serving Size:
0.5 cup (40 g)

FIBER	0.1 g	FAT	0.1 g
NET CARBS	1.9 g	PROTEIN	2.3 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Iodine	71% DV

Excellent Source

Polyphenols	45% DV

Good Source

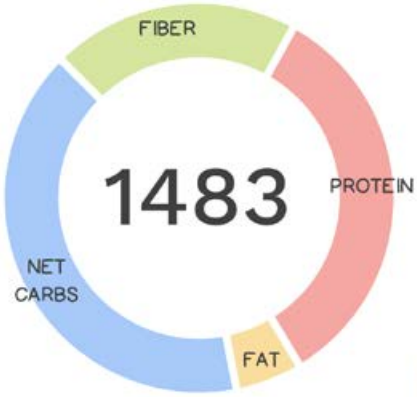
Copper	12% DV	Vitamin A	12% DV
Manganese	17% DV	Carotenoids	14% DV
Vitamin C	17% DV	EPA + DHA	13% DV
Vitamin B2	14% DV	Vitamin B7	15% DV
Vitamin B9	15% DV		

Portabella mushroom

SUPER

CALORIES: 19

Serving Size:
1 cup diced (86 g)



FIBER	1.1 g	FAT	0.3 g
NET CARBS	2.2 g	PROTEIN	1.8 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Ergothioneine	61% DV

Excellent Source

Copper	27% DV	Vitamin B7	46% DV
Selenium	29% DV		
Vitamin B3	24% DV		
Vitamin B5	20% DV		

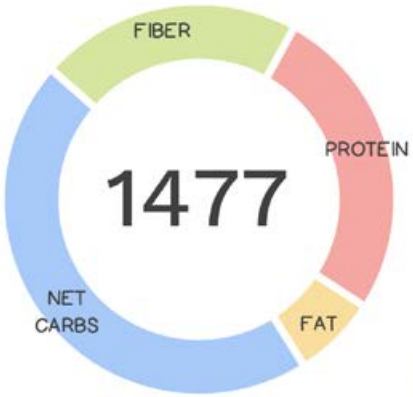
Good Source

Zucchini

SUPER

CALORIES: 19

Serving Size:
1 cup sliced, about 1 small (113



FIBER	1.1 g	FAT	0.4 g
NET CARBS	2.4 g	PROTEIN	1.4 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Polyphenols	122% DV

Excellent Source

Vitamin C	22% DV	Carotenoids	28% DV

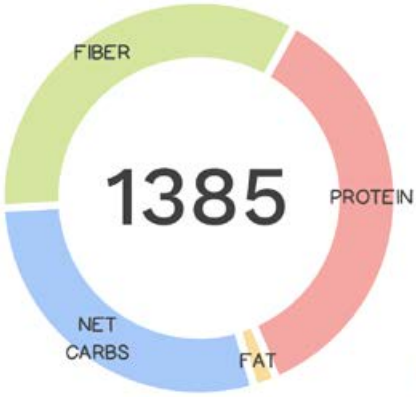
Good Source

Vitamin B6	11% DV	Vitamin B7	10% DV

Asparagus

SUPER

CALORIES: 27



FIBER	2.8 g	FAT	0.2 g
NET CARBS	2.4 g	PROTEIN	2.9 g

Serving Size:
1 cup or 7 large spears (134 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Ergothioneine	66% DV

Excellent Source

Copper	28% DV	Vitamin K	46% DV
		Polyphenols	24% DV

Good Source

Fiber	10% DV	Carotenoids	17% DV
Iron	16% DV	Vitamin E	11% DV
Vitamin B1	16% DV	Vitamin B7	16% DV
Vitamin B2	15% DV		
Vitamin B9	17% DV		

Cabbage, red

SUPER

CALORIES: 28

FIBER	1.9 g	FAT	0.1 g
NET CARBS	4.7 g	PROTEIN	1.3 g

Serving Size:
1 cup, chopped (89 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin C	56% DV	Polyphenols	76% DV
		Glucosinolates	120% DV

Excellent Source

Vitamin K	28% DV

Good Source

Vitamin B6	11% DV	Carotenoids	10% DV

Peppers, sweet, red

SUPER

CALORIES: 24

FIBER	1.9 g	FAT	0.3 g
NET CARBS	3.6 g	PROTEIN	0.9 g

Serving Size:

1 cup sliced, about 1 medium

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin C	131% DV

Excellent Source

Carotenoids	22% DV
Polyphenols	49% DV

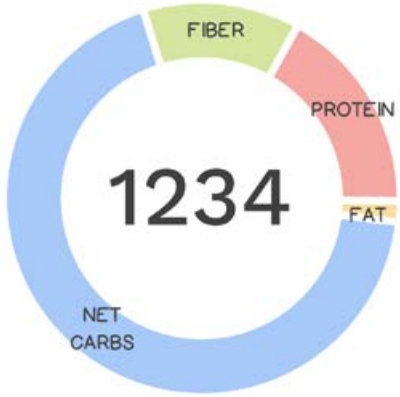
Good Source

Vitamin B6	16% DV	Vitamin A	16% DV
Vitamin B9	11% DV	Vitamin E	11% DV

Peppers, hot chili, green

SUPER

CALORIES: 15



FIBER	0.6 g	FAT	0.1 g
NET CARBS	3 g	PROTEIN	0.8 g

Serving Size:

1/4 cup, chopped or diced (37.5 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin C	101% DV

Excellent Source

Polyphenols	25% DV

Good Source

Alaskan king crab

SUPER

CALORIES: 97

Serving Size:
4 ounces (115 g)

FIBER	0 g	FAT	0.7 g
NET CARBS	0 g	PROTEIN	21 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Zinc	62% DV	EPA + DHA	214% DV
Copper	118% DV	Taurine	80% DV
Selenium	76% DV		
Iodine	162% DV		
Vitamin B12	431% DV		

Excellent Source

Protein	42% DV
Phosphorus	20% DV

Good Source

Magnesium	13% DV	Vitamin E	18% DV
Vitamin B6	10% DV	Vitamin B7	18% DV
Vitamin B9	13% DV		

Leeks

SUPER

CALORIES: 54

Serving Size:
1 cup (89 g)

FIBER	1.6 g	FAT	0.3 g
NET CARBS	11 g	PROTEIN	1.3 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Thiosulfinates	397% DV

Excellent Source

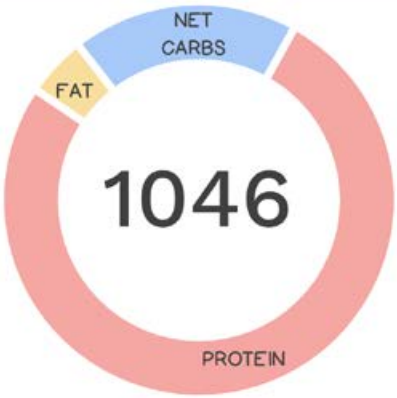
Carotenoids	29% DV
Vitamin K	35% DV

Good Source

Iron	10% DV
Copper	12% DV
Manganese	19% DV
Vitamin C	12% DV
Vitamin B6	12% DV
Vitamin B9	14% DV

Clams

SUPER



CALORIES: 99

Serving Size:
4 ounces (115 g)

FIBER	0 g	FAT	1.1 g
NET CARBS	4.1 g	PROTEIN	16.9 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Selenium	64% DV	Vitamin B7	87% DV
Iodine	120% DV	Taurine	150% DV
Vitamin B12	541% DV		

Excellent Source

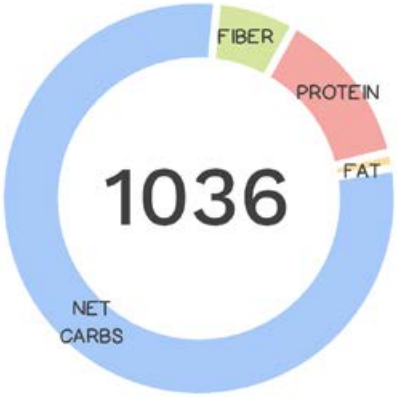
Protein	34% DV	EPA + DHA	49% DV

Good Source

Iron	10% DV	Vitamin A	12% DV
Phosphorus	18% DV	Vitamin E	15% DV
Choline	14% DV	CoQ10	18% DV

Pumpkin

SUPER



CALORIES: 30

Serving Size:
1 cup, 1" cubes (116 g)

FIBER	0.6 g	FAT	0.1 g
NET CARBS	7 g	PROTEIN	1.2 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin A	55% DV		
Carotenoids	111% DV		

Excellent Source

Polyphenols	23% DV		

Good Source

Copper	16% DV		
Vitamin C	12% DV		
Vitamin B2	10% DV		

Cocoa, unsweetened

SUPER

CALORIES: 64

Serving Size:
1 ounce (28 g)

FIBER	10.4 g	FAT	3.8 g
NET CARBS	5.9 g	PROTEIN	5.5 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Copper	118% DV	Polyphenols	281% DV

Excellent Source

Fiber	37% DV	Vitamin B7	25% DV
Iron	22% DV		
Magnesium	33% DV		
Manganese	47% DV		

Good Source

Protein	11% DV
Phosphorus	16% DV
Zinc	17% DV

Peppermint

SUPER

CALORIES: 4

Serving Size:
1/4 cup (6.4 g)

FIBER	0.5 g	FAT	0.1 g
NET CARBS	0.4 g	PROTEIN	0.2 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Excellent Source

Polyphenols	21% DV

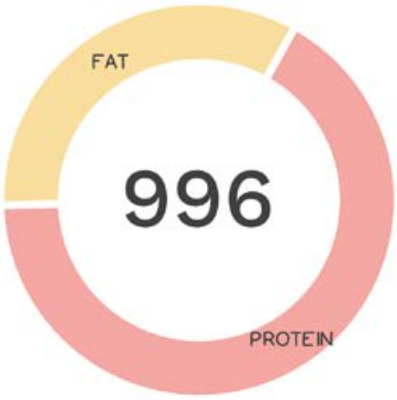
Good Source

Herring, Atlantic

SUPER

CALORIES: 182

Serving Size:
4 ounces (115 g)



FIBER	0 g	FAT	10.4 g
NET CARBS	0 g	PROTEIN	20.7 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Selenium	76% DV	EPA + DHA	723% DV
Vitamin B12	655% DV		

Excellent Source

Protein	41% DV	Vitamin D	24% DV
Phosphorus	22% DV	MUFA	21% DV
Iodine	23% DV	Vitamin B7	38% DV
Vitamin B2	21% DV	CoQ10	30% DV
Vitamin B3	23% DV		
Vitamin B6	20% DV		

Good Source

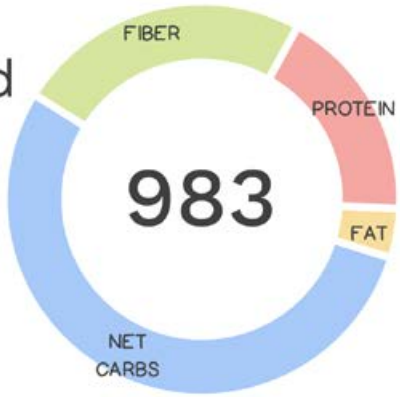
Zinc	10% DV	Taurine	17% DV
Copper	12% DV		
Vitamin B5	15% DV		
Choline	14% DV		

Tomatoes, red

SUPER

CALORIES: 32

Serving Size:
1 cup or 1 large (180 g)



FIBER	2.2 g	FAT	0.4 g
NET CARBS	4.8 g	PROTEIN	1.6 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Carotenoids	107% DV

Excellent Source

Vitamin C	27% DV	Polyphenols	32% DV
		Vitamin B7	24% DV

Good Source

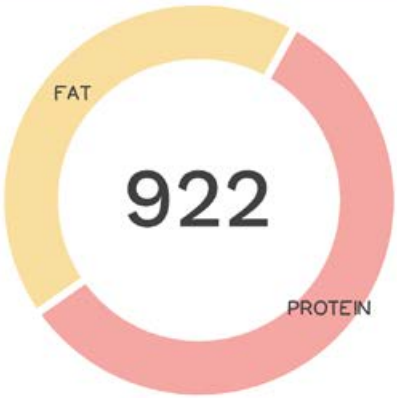
Copper	12% DV	Vitamin K	12% DV

Mackerel, Atlantic

SUPER

CALORIES: 236

Serving Size:
4 ounces (115 g)



FIBER	0 g	FAT	16 g
NET CARBS	0 g	PROTEIN	21.4 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Selenium	92% DV	Vitamin D	93% DV
Vitamin B3	65% DV	EPA + DHA	1058% DV
Vitamin B12	417% DV	CoQ10	130% DV

Excellent Source

Protein	43% DV	MUFA	31% DV
Magnesium	21% DV	Vitamin B7	27% DV
Phosphorus	20% DV	Taurine	22% DV
Iodine	26% DV		
Vitamin B2	28% DV		
Vitamin B5	20% DV		
Vitamin B6	27% DV		

Good Source

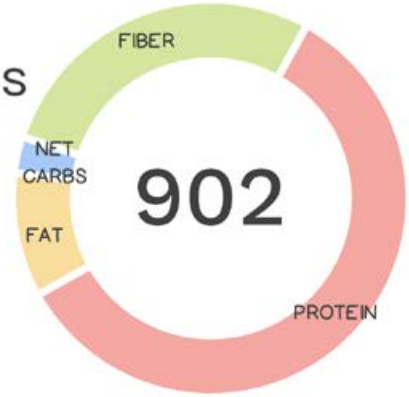
Iron	10% DV	Vitamin E	12% DV
Vitamin B1	17% DV	ALA	11% DV
Choline	14% DV		

Alfalfa Sprouts

SUPER

CALORIES: 8

Serving Size:
1 cup (33 g)



FIBER	0.6 g	FAT	0.2 g
NET CARBS	0.1 g	PROTEIN	1.3 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Excellent Source

Good Source

Carrots

SUPER

CALORIES: 52

FIBER	3.6 g	FAT	0.3 g
NET CARBS	8.7 g	PROTEIN	1.2 g

Serving Size:
I cup or 2 medium (128 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin A	119% DV
Carotenoids	171% DV

Excellent Source

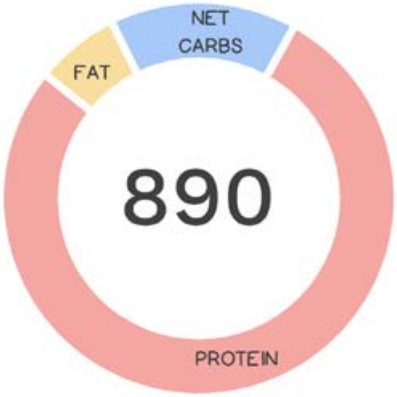
Polyphenols	25% DV
Vitamin B7	21% DV

Good Source

Fiber	13% DV	Vitamin K	14% DV
Vitamin B6	10% DV		

Squid

SUPER



CALORIES: 106

FIBER	0 g	FAT	1.6 g
NET CARBS	3.5 g	PROTEIN	17.9 g

Serving Size:
4 ounces (115 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Copper	242% DV	EPA + DHA	224% DV
Selenium	94% DV	Taurine	103% DV
Vitamin B12	62% DV		

Excellent Source

Protein	36% DV
Phosphorus	20% DV
Vitamin B2	36% DV

Good Source

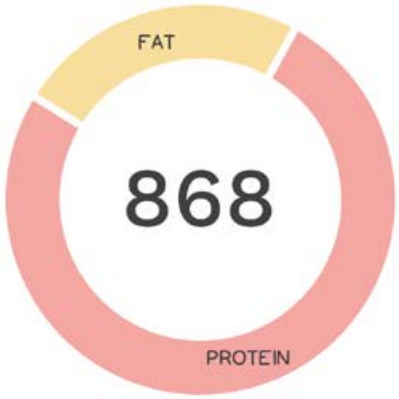
Zinc	16% DV	Vitamin B7	19% DV
Iodine	15% DV		
Vitamin B3	16% DV		
Vitamin B5	12% DV		
Choline	14% DV		

Salmon, Wild Atlantic

SUPER

CALORIES: 163

Serving Size:
4 ounces (115 g)



FIBER	0 g	FAT	7.3 g
NET CARBS	0 g	PROTEIN	22.8 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Selenium	76% DV	Vitamin D	52% DV
Vitamin B3	56% DV	EPA + DHA	661% DV
Vitamin B6	55% DV		
Vitamin B12	152% DV		

Excellent Source

Protein	46% DV	ALA	21% DV
Copper	32% DV	Vitamin B7	39% DV
Iodine	23% DV		
Vitamin B1	22% DV		
Vitamin B2	34% DV		
Vitamin B5	38% DV		
Choline	23% DV		

Good Source

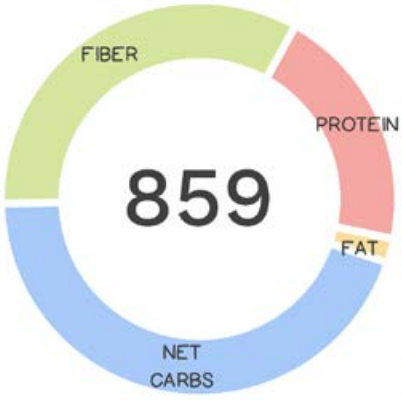
Phosphorus	18% DV	Carotenoids	13% DV
Potassium	12% DV	MUFA	12% DV
		CoQ10	15% DV
		Taurine	17% DV

Okra

SUPER

CALORIES: 33

Serving Size:
1 cup (100 g)



FIBER	3.2 g	FAT	0.2 g
NET CARBS	4.3 g	PROTEIN	1.9 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Excellent Source

Manganese	34% DV	Vitamin K	26% DV
Vitamin C	26% DV	Polyphenols	29% DV
		Vitamin B7	20% DV

Good Source

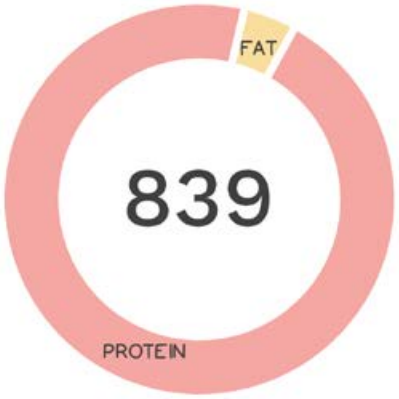
Fiber	11% DV
Magnesium	14% DV
Copper	12% DV
Vitamin B1	17% DV
Vitamin B6	13% DV
Vitamin B9	15% DV

Lobster, Northern

SUPER

CALORIES: 89

Serving Size:
4 ounces (115 g)



FIBER	0 g	FAT	0.9 g
NET CARBS	0 g	PROTEIN	19 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Copper	172% DV	EPA + DHA	78% DV
Selenium	133% DV	Taurine	80% DV
Iodine	80% DV		
Vitamin B12	60% DV		

Excellent Source

Protein	38% DV
Zinc	37% DV
Vitamin B5	33% DV

Good Source

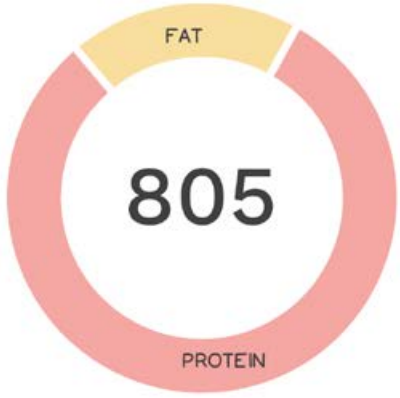
Magnesium	10% DV	Vitamin B7	19% DV
Phosphorus	15% DV		
Vitamin B3	11% DV		
Choline	15% DV		

Anchovies

SUPER

CALORIES: 151

Serving Size:
4 ounces (115 g)



FIBER	0 g	FAT	5.6 g
NET CARBS	0 g	PROTEIN	23.4 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Selenium	76% DV	EPA + DHA	667% DV
Vitamin B3	101% DV	Vitamin B7	70% DV

Excellent Source

Protein	47% DV
Iron	21% DV
Copper	27% DV
Iodine	35% DV
Vitamin B2	23% DV
Vitamin B12	30% DV

Good Source

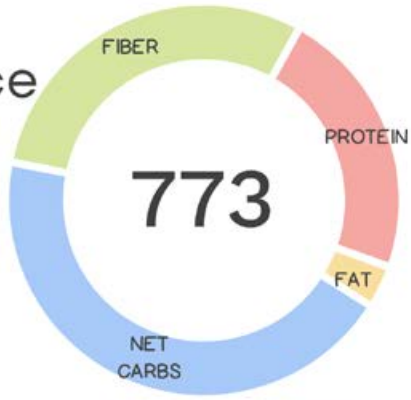
Calcium	13% DV	CoQ10	15% DV
Magnesium	11% DV	Taurine	17% DV
Phosphorus	16% DV		
Zinc	18% DV		
Vitamin B5	15% DV		
Vitamin B6	10% DV		
Choline	11% DV		

Iceberg lettuce

HIGH

CALORIES: 16

Serving Size:
2 cups chopped (114 g)



FIBER	1.4 g	FAT	0.2 g
NET CARBS	2 g	PROTEIN	1 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Excellent Source

Vitamin K	23% DV

Good Source

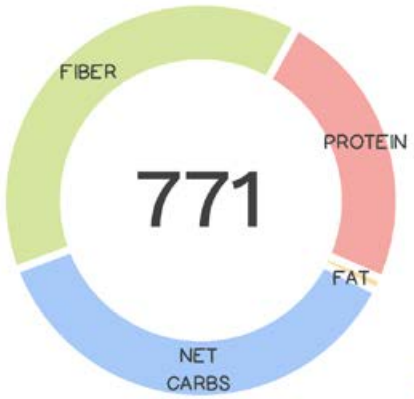
Polyphenols	19% DV

Artichokes

HIGH

CALORIES: 60

Serving Size:
1 medium (128 g)



FIBER	6.9 g	FAT	0.2 g
NET CARBS	6.5 g	PROTEIN	4.2 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Polyphenols	209% DV

Excellent Source

Fiber	25% DV
Copper	33% DV
Vitamin B9	22% DV

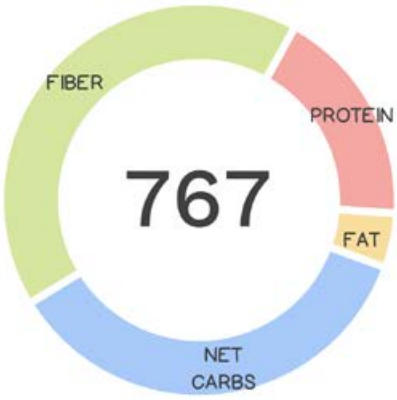
Good Source

Magnesium	18% DV	Vitamin K	16% DV
Potassium	10% DV		
Manganese	14% DV		
Vitamin C	17% DV		

Celery

HIGH

CALORIES: 14



FIBER	1.6 g	FAT	0.2 g
NET CARBS	1.4 g	PROTEIN	0.7 g

Serving Size:
1 cup or 1.5 large stalks (101 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Excellent Source

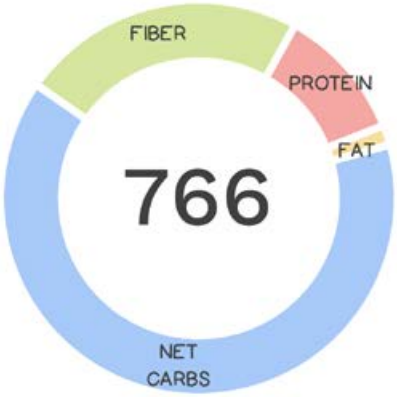
Vitamin K	25% DV

Good Source

Rutabaga

HIGH

CALORIES: 52



FIBER	3.2 g	FAT	0.2 g
NET CARBS	8.8 g	PROTEIN	1.5 g

Serving Size:
1 cup (140 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Glucosinolates	215% DV

Excellent Source

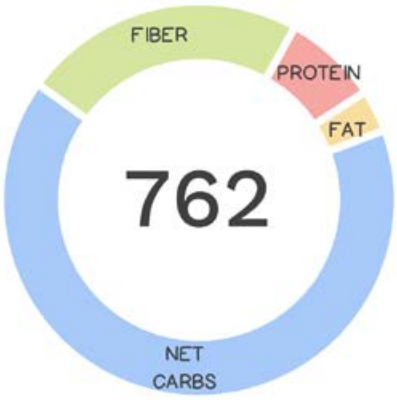
Vitamin C	39% DV	Polyphenols	26% DV

Good Source

Fiber	12% DV
Vitamin B1	11% DV

Strawberries

HIGH



CALORIES: 49

FIBER	3 g	FAT	0.5 g
NET CARBS	8.6 g	PROTEIN	1 g

Serving Size:
1 cup or 13 medium (152 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin C	99% DV	Phytosterols	55% DV
		Polyphenols	84% DV

Excellent Source

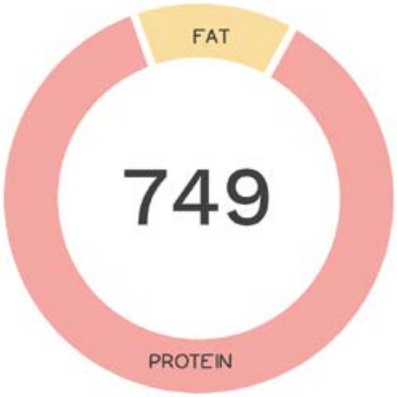
Manganese	26% DV	Vitamin B7	20% DV

Good Source

Fiber	11% DV

Flatfish

HIGH



CALORIES: 81

FIBER	0 g	FAT	2.2 g
NET CARBS	0 g	PROTEIN	14.3 g

Serving Size:
4 ounces (115 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Selenium	56% DV	EPA + DHA	113% DV
Vitamin B12	54% DV	Vitamin B7	170% DV
		Taurine	74% DV

Excellent Source

Protein	29% DV
Phosphorus	23% DV

Good Source

Iodine	19% DV	Vitamin D	16% DV
Choline	14% DV	CoQ10	11% DV

Blackberries

HIGH

CALORIES: 62

Serving Size:
1 cup (144 g)

FIBER	7.6 g	FAT	0.7 g
NET CARBS	6.2 g	PROTEIN	2 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Polyphenols	190% DV

Excellent Source

Fiber	27% DV	Vitamin E	33% DV
Copper	26% DV	Vitamin K	24% DV
Manganese	40% DV		
Vitamin C	34% DV		

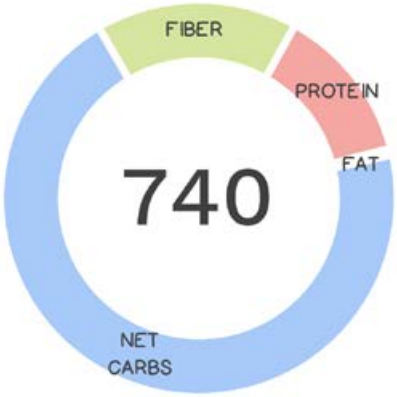
Good Source

Shallots

HIGH

CALORIES: 115

Serving Size:
1 cup (160 g)



FIBER	5.1 g	FAT	0.2 g
NET CARBS	21.8 g	PROTEIN	4 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Thiosulfinates	628% DV

Excellent Source

Manganese	20% DV	Polyphenols	23% DV
Vitamin B6	32% DV		

Good Source

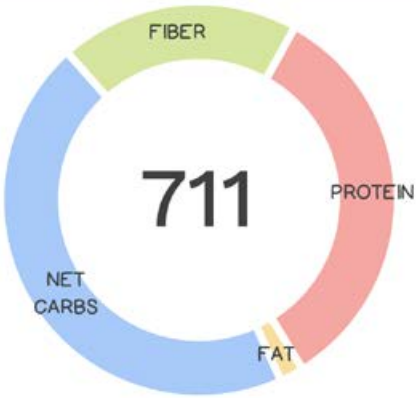
Fiber	18% DV
Iron	11% DV
Potassium	11% DV
Copper	16% DV
Vitamin C	14% DV
Vitamin B9	14% DV

Mung Bean Sprouts

HIGH

CALORIES: 31

Serving Size:
1 cup (104 g)



FIBER	1.9 g	FAT	0.2 g
NET CARBS	4.3 g	PROTEIN	3.2 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Excellent Source

Vitamin K	29% DV
Polyphenols	49% DV

Good Source

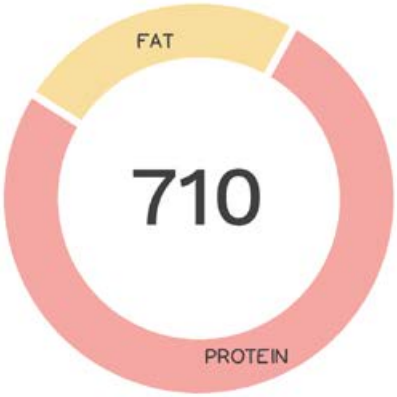
Copper	19% DV
Vitamin C	15% DV
Vitamin B2	10% DV
Vitamin B9	16% DV

Trout

HIGH

CALORIES: 170

Serving Size:
4 ounces (115 g)



FIBER	0 g	FAT	7.6 g
NET CARBS	0 g	PROTEIN	23.9 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin B12	373% DV	EPA + DHA	336% DV

Excellent Source

Protein	48% DV	Carotenoids	32% DV
Phosphorus	23% DV	Vitamin D	22% DV
Copper	24% DV	Vitamin B7	20% DV
Manganese	43% DV	CoQ10	21% DV
Selenium	26% DV		
Vitamin B1	34% DV		
Vitamin B2	29% DV		
Vitamin B3	32% DV		
Vitamin B5	45% DV		

Good Source

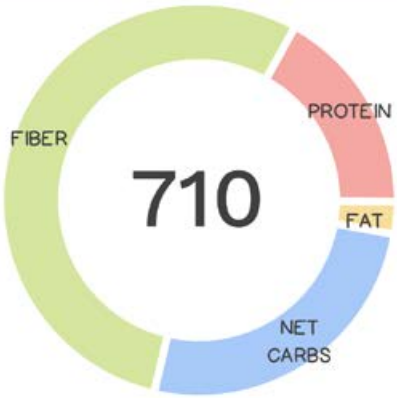
Iron	10% DV	MUFA	19% DV
Iodine	19% DV	ALA	11% DV
Vitamin B6	14% DV	Taurine	17% DV
Choline	14% DV		

Sauerkraut

HIGH

CALORIES: 27

Serving Size:
1 cup (142 g)



FIBER	4.1 g	FAT	0.2 g
NET CARBS	2 g	PROTEIN	1.3 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Excellent Source

Vitamin C	23% DV	Glucosinolates	22% DV

Good Source

Fiber	15% DV	Vitamin K	15% DV
Iron	12% DV	Polyphenols	15% DV
Copper	15% DV		
Vitamin B6	11% DV		

Pickles, sour

HIGH

CALORIES: 17

Serving Size:
1 cup (155 g)

FIBER	1.9 g	FAT	0.3 g
NET CARBS	1.6 g	PROTEIN	0.5 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin K	61% DV

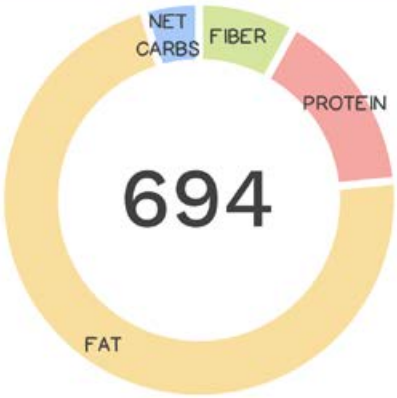
Excellent Source

Good Source

Copper	15% DV

Brazil nuts

HIGH



CALORIES: 185

FIBER	2.1 g	FAT	18.8 g
NET CARBS	1.2 g	PROTEIN	4 g

Serving Size:
palmful, or 6 nuts (28 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Copper	54% DV
Selenium	976% DV

Excellent Source

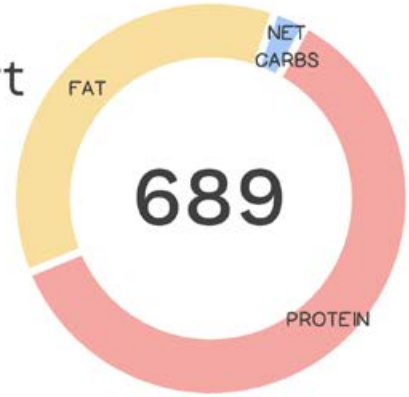
Magnesium	25% DV	Vitamin E	30% DV
		MUFA	33% DV
		Linoleic Acid	40% DV

Good Source

Phosphorus	16% DV	Polyphenols	14% DV
Zinc	10% DV		
Manganese	15% DV		
Vitamin B1	14% DV		

Chicken, heart

HIGH



CALORIES: 153

FIBER	0 g	FAT	9.3 g
NET CARBS	0.7 g	PROTEIN	15.6 g

Serving Size:
3.5 ounces (100 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Zinc	60% DV	CoQ10	320% DV
Vitamin B2	56% DV		
Vitamin B5	51% DV		
Vitamin B12	304% DV		

Excellent Source

Protein	31% DV	Taurine	42% DV
Iron	33% DV		
Copper	38% DV		
Vitamin B3	31% DV		
Vitamin B6	21% DV		

Good Source

Phosphorus	14% DV	MUFA	12% DV
Vitamin B1	13% DV	Linoleic Acid	11% DV
Vitamin B9	18% DV	Vitamin B7	12% DV

Butternut squash

HIGH

CALORIES: 63

Serving Size:
1 cup cubes (140 g)

FIBER	2.8 g	FAT	0.1 g
NET CARBS	13.6 g	PROTEIN	1.4 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin A	83% DV
Carotenoids	133% DV

Excellent Source

Vitamin C	33% DV

Good Source

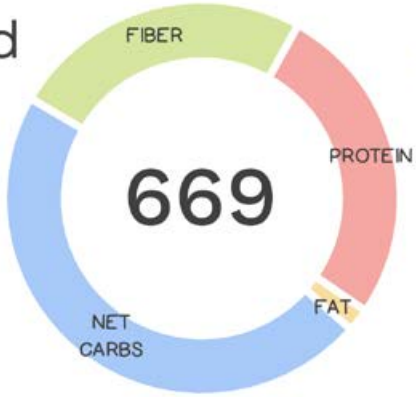
Fiber	10% DV	Vitamin E	13% DV
Magnesium	11% DV		
Potassium	10% DV		
Copper	11% DV		
Manganese	12% DV		
Vitamin B1	12% DV		
Vitamin B3	11% DV		
Vitamin B5	11% DV		
Vitamin B6	13% DV		

Edible-podded Peas

HIGH

CALORIES: 41

Serving Size:
1 cup, chopped (98 g)



FIBER	2.5 g	FAT	0.2 g
NET CARBS	4.9 g	PROTEIN	2.7 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin C	65% DV

Excellent Source

Vitamin K	20% DV
Vitamin B7	31% DV

Good Source

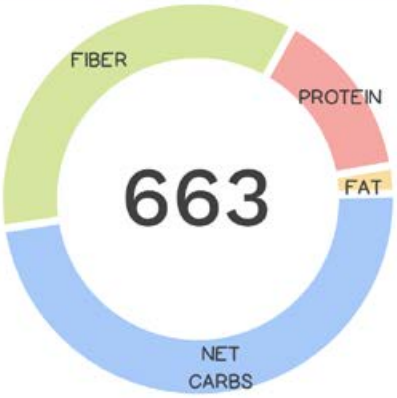
Iron	11% DV	Carotenoids	15% DV
Manganese	10% DV		
Vitamin B1	12% DV		
Vitamin B5	15% DV		
Vitamin B9	10% DV		

Fennel

HIGH

CALORIES: 28

Serving Size:
1 cup sliced (89 g)



FIBER	2.8 g	FAT	0.2 g
NET CARBS	3.7 g	PROTEIN	1.1 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Excellent Source

Vitamin K	47% DV
Polyphenols	31% DV

Good Source

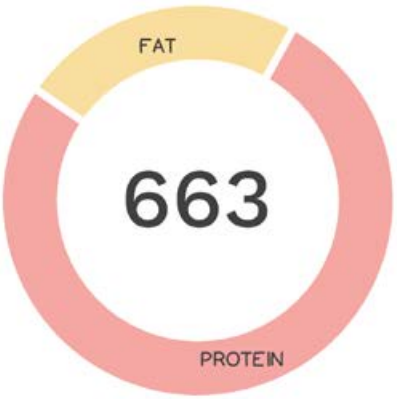
Fiber	10% DV	Carotenoids	12% DV
Vitamin C	12% DV		

Whitefish

HIGH

CALORIES: 154

Serving Size:
4 ounces (115 g)



FIBER	0 g	FAT	6.7 g
NET CARBS	0 g	PROTEIN	22 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin D	69% DV
EPA + DHA	579% DV

Excellent Source

Protein	44% DV	Taurine	43% DV
Phosphorus	25% DV		
Selenium	26% DV		
Vitamin B3	22% DV		
Vitamin B6	20% DV		
Vitamin B12	48% DV		

Good Source

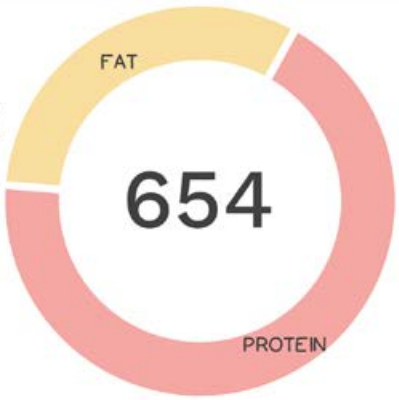
Zinc	10% DV	MUFA	11% DV
Iodine	15% DV	ALA	13% DV
Vitamin B1	13% DV	Vitamin B7	10% DV
Vitamin B2	11% DV		
Vitamin B5	17% DV		
Choline	14% DV		

Sardines (canned in oil)

HIGH

CALORIES: 239

Serving Size:
4 ounces (115 g)



FIBER	0 g	FAT	13.2 g
NET CARBS	0 g	PROTEIN	28.3 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Protein	57% DV	EPA + DHA	452% DV
Selenium	110% DV	Vitamin B7	92% DV
Vitamin B12	428% DV		

Excellent Source

Calcium	34% DV	Vitamin D	28% DV
Phosphorus	45% DV	MUFA	22% DV
Copper	24% DV	Linoleic Acid	24% DV
Vitamin B2	20% DV	ALA	36% DV
Vitamin B3	38% DV	CoQ10	23% DV

Good Source

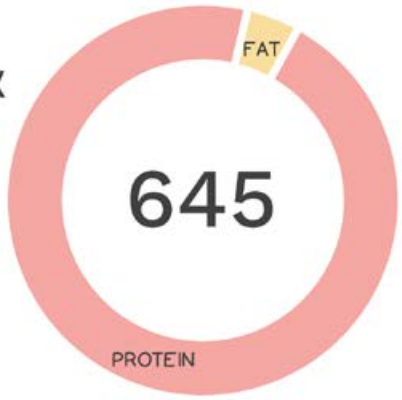
Iron	19% DV	Vitamin E	16% DV
Magnesium	11% DV	Taurine	17% DV
Potassium	10% DV		
Zinc	14% DV		
Iodine	19% DV		
Vitamin B5	15% DV		
Vitamin B6	11% DV		
Choline	16% DV		

Tuna, Skipjack

HIGH

CALORIES: 118

Serving Size:
4 ounces (115 g)



FIBER	0 g	FAT	1.2 g
NET CARBS	0 g	PROTEIN	25.3 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Protein	51% DV	EPA + DHA	118% DV
Selenium	76% DV	Taurine	95% DV
Vitamin B3	111% DV		
Vitamin B6	58% DV		
Vitamin B12	91% DV		

Excellent Source

Phosphorus	20% DV	Vitamin B7	22% DV

Good Source

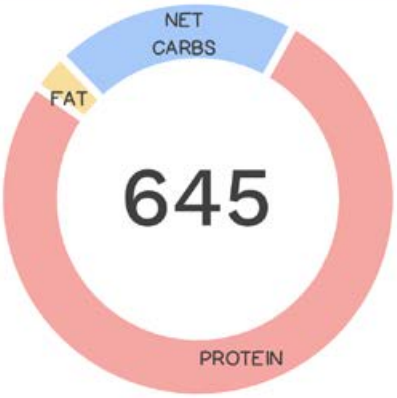
Potassium	10% DV	Vitamin D	16% DV
Copper	11% DV	ALA	15% DV
Iodine	12% DV		
Vitamin B5	10% DV		

Scallops

HIGH

CALORIES: 79

Serving Size:
4 ounces (115 g)



FIBER	0 g	FAT	0.6 g
NET CARBS	3.7 g	PROTEIN	13.9 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin B12	68% DV	Taurine	238% DV

Excellent Source

Protein	28% DV	EPA + DHA	47% DV
Phosphorus	31% DV		
Selenium	27% DV		

Good Source

Zinc	10% DV	Vitamin B7	11% DV
Iodine	14% DV	CoQ10	10% DV
Choline	14% DV		

Papaya

HIGH

CALORIES: 62

Serving Size:
1 cup 1" pieces (145 g)

FIBER	2.5 g	FAT	0.4 g
NET CARBS	20.3 g	PROTEIN	0.7 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin C	137% DV	Glucosinolates	89% DV

Excellent Source

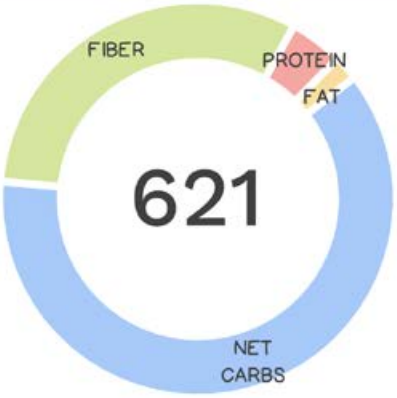
Carotenoids	45% DV
Polyphenols	29% DV

Good Source

Vitamin B9	13% DV

Pears, Asian

HIGH



CALORIES: 51

FIBER	4.4 g	FAT	0.3 g
NET CARBS	8.6 g	PROTEIN	0.6 g

Serving Size:
1 cup sliced (about 1 small)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Polyphenols	250% DV

Excellent Source

Good Source

Fiber	16% DV

Green Beans

HIGH

CALORIES: 31

FIBER	2.7 g	FAT	0.2 g
NET CARBS	4.3 g	PROTEIN	1.8 g

Serving Size:
1 cup, chopped (100 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Excellent Source

Vitamin K	36% DV

Good Source

Fiber	10% DV	Carotenoids	12% DV
Vitamin C	14% DV		

Eggplant

HIGH

CALORIES: 21

FIBER	2.5 g	FAT	0.1 g
NET CARBS	2.4 g	PROTEIN	0.8 g

Serving Size:
1 cup cubes (82 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

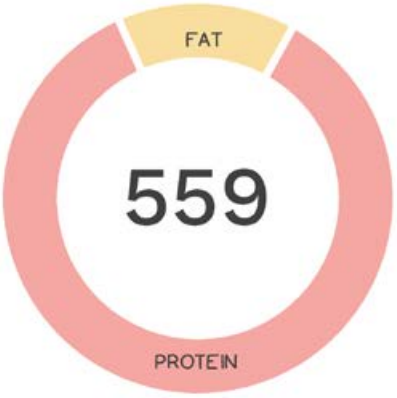
Excellent Source

Polyphenols	35% DV

Good Source

Catfish, wild

HIGH



CALORIES: 109

FIBER	0 g	FAT	3.2 g
NET CARBS	0 g	PROTEIN	18.8 g

Serving Size:
4 ounces (115 g)

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin B12	107% DV	Vitamin D	72% DV
		EPA + DHA	167% DV

Excellent Source

Protein	38% DV	Taurine	43% DV
Selenium	26% DV		
Vitamin B1	20% DV		

Good Source

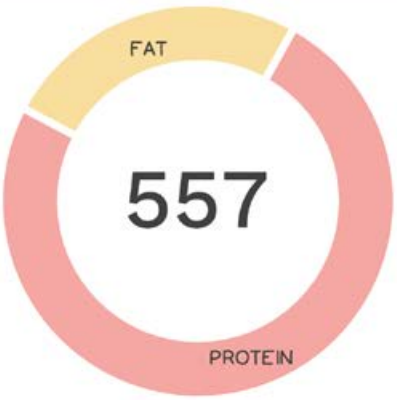
Phosphorus	19% DV
Vitamin B3	14% DV
Vitamin B5	18% DV
Choline	14% DV

Swordfish

HIGH

CALORIES: 166

Serving Size:
4 ounces (115 g)



FIBER	0 g	FAT	7.6 g
NET CARBS	0 g	PROTEIN	22.6 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Selenium	120% DV	Vitamin D	80% DV
Vitamin B3	56% DV	EPA + DHA	348% DV
Vitamin B12	81% DV		

Excellent Source

Protein	45% DV
Phosphorus	23% DV
Vitamin B6	37% DV

Good Source

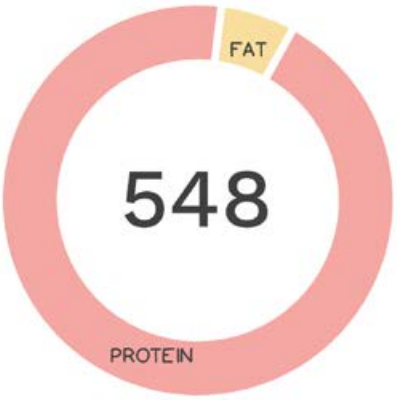
Potassium	10% DV	Vitamin E	16% DV
Iodine	12% DV	MUFA	17% DV
Choline	14% DV	Vitamin B7	10% DV
		Taurine	15% DV

Snapper

HIGH

CALORIES: 115

Serving Size:
4 ounces (115 g)



FIBER	0 g	FAT	1.5 g
NET CARBS	0 g	PROTEIN	23.6 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Selenium	80% DV	Vitamin D	59% DV
Vitamin B12	144% DV	EPA + DHA	143% DV

Excellent Source

Protein	47% DV
Vitamin B6	27% DV

Good Source

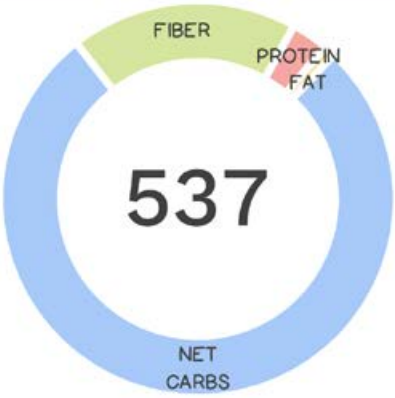
Phosphorus	18% DV	Vitamin B7	10% DV
Potassium	10% DV	CoQ10	15% DV
Iodine	15% DV	Taurine	17% DV
Vitamin B5	17% DV		
Choline	14% DV		

Persimmons, Japanese

HIGH

CALORIES: 118

Serving Size:
1 cup diced (168 g)



FIBER	6 g	FAT	0.3 g
NET CARBS	25.2 g	PROTEIN	1 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin C	236% DV	Carotenoids	50% DV
		Polyphenols	193% DV

Excellent Source

Fiber	22% DV
Copper	21% DV
Manganese	26% DV

Good Source

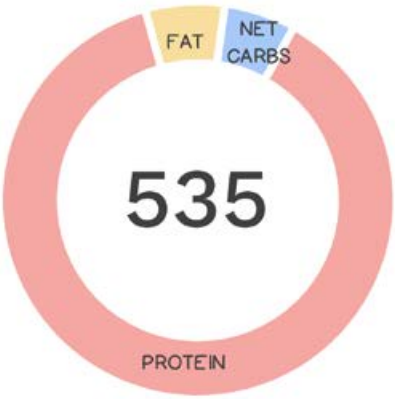
Vitamin B6	10% DV	Vitamin A	15% DV
		Vitamin B7	11% DV

Shrimp

HIGH

CALORIES: 82

Serving Size:
4 ounces (115 g)



FIBER	0 g	FAT	1.2 g
NET CARBS	1 g	PROTEIN	15.7 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Selenium	62% DV	EPA + DHA	63% DV
Iodine	161% DV		
Vitamin B12	53% DV		

Excellent Source

Protein	31% DV	Carotenoids	23% DV
Phosphorus	22% DV	Taurine	45% DV
Copper	23% DV		

Good Source

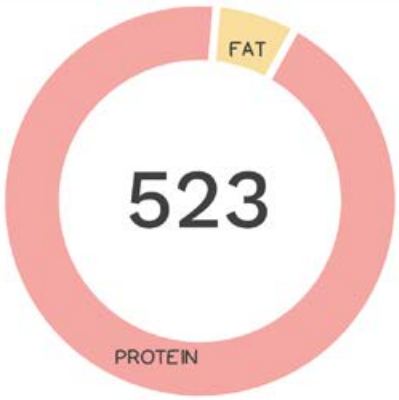
Zinc	10% DV	Vitamin E	11% DV
Vitamin B3	13% DV	Vitamin B7	10% DV
Vitamin B6	11% DV		
Choline	17% DV		

Halibut

HIGH

CALORIES: 105

Serving Size:
4 ounces (115 g)



FIBER	0 g	FAT	1.5 g
NET CARBS	0 g	PROTEIN	21.3 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Selenium	95% DV	EPA + DHA	89% DV
Vitamin B12	53% DV		

Excellent Source

Protein	43% DV	Vitamin D	27% DV
Phosphorus	22% DV	Vitamin B7	39% DV
Vitamin B3	47% DV	CoQ10	28% DV
Vitamin B6	37% DV		

Good Source

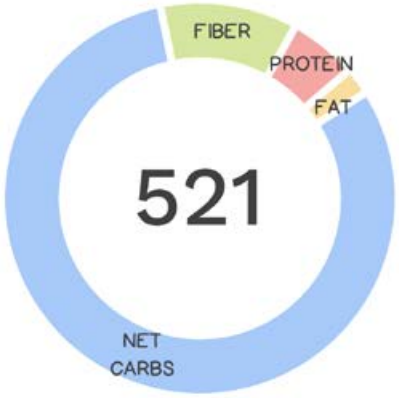
Potassium	11% DV
Iodine	16% DV
Choline	13% DV

Plums

HIGH

CALORIES: 76

Serving Size:
1 cup sliced (3 small) (165 g)



FIBER	2.3 g	FAT	0.5 g
NET CARBS	16.5 g	PROTEIN	1.2 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Polyphenols	289% DV

Excellent Source

Good Source

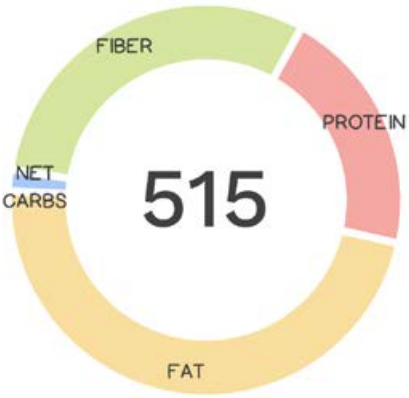
Copper	10% DV
Vitamin C	17% DV

Flaxseed

HIGH

CALORIES: 150

Serving Size:
1 ounce (28 g)



FIBER	7.6 g	FAT	11.8 g
NET CARBS	0.4 g	PROTEIN	5.1 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

ALA	399% DV

Excellent Source

Fiber	27% DV	Vitamin E	38% DV
Magnesium	26% DV	Polyphenols	44% DV
Copper	38% DV		
Manganese	30% DV		
Vitamin B1	38% DV		

Good Source

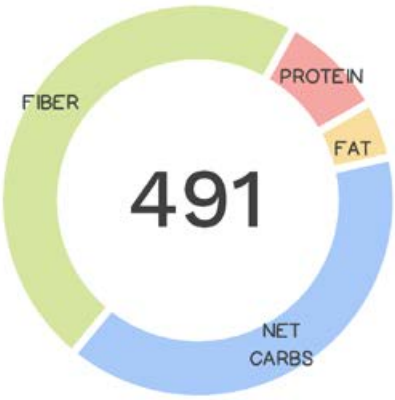
Protein	10% DV	MUFA	11% DV
Phosphorus	14% DV	Linoleic Acid	10% DV
Zinc	11% DV		
Selenium	13% DV		

Raspberries

HIGH

CALORIES: 64

Serving Size:
1 cup (123 g)



FIBER	8 g	FAT	0.8 g
NET CARBS	6.7 g	PROTEIN	1.5 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Polyphenols	79% DV

Excellent Source

Fiber	29% DV	Vitamin E	28% DV
Manganese	36% DV		
Vitamin C	36% DV		

Good Source

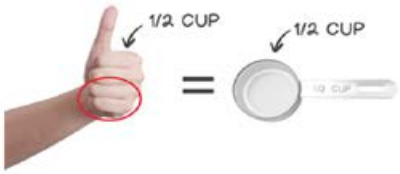
Copper	12% DV	ALA	10% DV

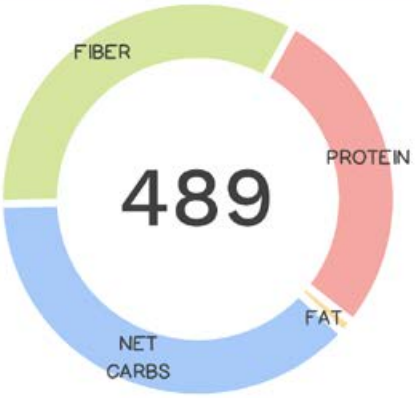
Lentils

HIGH

CALORIES: 137

Serving Size:
1/2 cup cooked (1/5 cup raw)





FIBER	11.6 g	FAT	0.4 g
NET CARBS	13.1 g	PROTEIN	9.6 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Polyphenols	330% DV

Excellent Source

Fiber	42% DV	Vitamin B7	30% DV
Copper	33% DV		
Manganese	24% DV		
Vitamin B1	28% DV		
Vitamin B9	47% DV		

Good Source

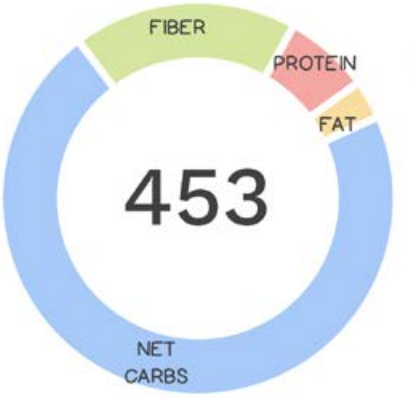
Protein	19% DV	Vitamin E	12% DV
Iron	14% DV		
Zinc	12% DV		
Vitamin B5	17% DV		
Vitamin B6	12% DV		

Kiwi, green

HIGH

CALORIES: 110

Serving Size:
1 cup sliced (2 fruit) (180 g)



FIBER	5.4 g	FAT	0.9 g
NET CARBS	21 g	PROTEIN	2.1 g

- FUNCTIONAL FATS
- PHYTONUTRIENTS
- MINERALS
- NONPROTEINOGENIC AMINO ACIDS
- VITAMINS & VITAMINLIKE COMPOUNDS

Best Source

Vitamin C	185% DV	Vitamin K	60% DV
		Polyphenols	63% DV

Excellent Source

Copper	26% DV

Good Source

Fiber	19% DV	Vitamin E	19% DV
Potassium	12% DV	Myo-inositol	16% DV
Vitamin B9	11% DV		